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ANNALS *of* SURGERY

Vol. XCII JULY, 1930 No. 1

ON THE CAUSES OF POST-OPERATIVE DEATHS*

By Gustaf Petrén, M.D.

of Lund, Sweden

FROM THE SURGICAL CLINIC UNIVERSITY OF LUND

On this occasion, when so many American colleagues are honoring Lund and its clinics with a visit, it appears appropriate to give a short survey of the post-operative deaths at the Lund Surgical Clinic. Respecting the material it may be mentioned by way of introduction that the annual number of clinic patients during recent years has been about or a little more than 3000, the yearly number of clinical operations about 2000 and the average number of resident patients roughly 200. This address gives a classification of the post-operative deaths at the Lund Surgical Clinic during the period 1922–1928, *i.e.*, during the last seven years.

Over fifteen years ago I published in *Bruns Beiträge*[1] a similar study of the operative mortality at the Lund Clinic for the years 1906–1910, which study, however, followed partly other lines. In a contribution to *Zentralbl. f. Chirurg.*[2] an account was given on the same lines as here, though this covered a smaller number of cases than the present study.

As a post-operative death *every* case has been classed that was operated on at the clinic and that died at the clinic after surgical intervention, thus also including, for instance, a cancer of the stomach where a palliative gastro-enterostomy was made and where for humane reasons the patient was allowed to remain at the Clinic and died there after about three months *cachectio modo*. A few of these post-operative deaths are therefore only post-operative in the sense that the patient had undergone an operation, without the lethal issue of the case having any causal connection with the operation undergone. From a strictly scientific point of view these cases ought not to have a place in the collection, but, for purely practical reasons, they are none the less included, as otherwise it would be difficult to draw a limit and the result might easily be a somewhat arbitrary inclusion or exclusion of some of the cases. Thus, then, *all* who died at the Clinic following an operation are included. As will be seen from the tables given below, an attempt has been made to bring all the fatal cases within certain groups in order to give a more comprehensive view of the real causes of death in the operative material of the Clinic.

Quite naturally, several lethal factors compete with one another in a

* Address before the members of the Inter-State Post-Graduate Medical Association of North America, June 14, 1929.

certain number of cases. Classification may then be difficult and at times seems rather arbitrary. The cases have been placed in that group where the essential cause of death was to be sought. I would expressly stress that in doing this I have also endeavored as objectively as possible to refer the cases to the groups especially disagreeable to surgeons. If, in a collection of this kind, one consciously or unconsciously seeks in the least degree to protect the surgery or oneself, the figures will quite naturally present a more or less false picture.

What shape the operative mortality takes at a surgical clinic depends of course on several different circumstances: the proportion between the more risky major operations and the minor ones, the proportion between operations of "pure" cases and acute infections, the relative number of bad, very advanced cases in the material of, for instance, peritonitis, septicopyæmia, cancer and others. A large central hospital generally has a relatively larger number of cases with uncertain or bad prognosis than a smaller institution. Further, it is evident that such factors as the operator's conscientiousness, experience and technical skill play a certain part, as also undoubtedly his disposition and temperament: a bold and energetic surgeon operating on wide indications, who frequently attempts major radical operations and in general does not shrink surgical measures in more or less desperate situations, will most likely get a larger number of post-operative deaths than the conservative surgeon, who is more cautious and operates on stricter indications. Hence the operative mortality is influenced by many different factors, and the absolute mortality figures are not therefore always *in et per se* of so great interest. A critical analysis of the causes of death, on the other hand, is always of value.

Before presenting the classification of all the post-operative deaths for these seven years, I will first tabulate the figures from some rather large and important groups of operations within different branches of surgery and give particulars of the causes of death.

Included here are:

1. Operations for brain tumor, both palliative (the majority) and radical.
2. Operations for exophthalmic goitre, during recent years mostly subtotal strumectomy.
3. Operations for gall-stone and its complications: cholecystitis, peritonitis, choledocholithiasis, cholangitis. Cholecystectomy (in most cases), cholecystostomy (in a few cases), choledochotomy.
4. The appendicitis material.
5. Operations on kidney or ureter for calculus, tuberculosis, tumor, hydronephrosis, pyonephrosis, rupture of kidney.
6. Operations for prostatic hypertrophy. Prostatectomy (all transvesical).

During this period seventy-nine cranial trepanations were performed for *brain tumor* (cerebral and cerebellar) with twenty deaths. In sixty-eight cases (fifteen deaths) the operation was Cushing's decompression trephining or an exploratory trephining, possibly with puncture or a test excision

of brain; in eleven cases (five deaths) the tumor was completely or partially removed. Patients suffering from brain tumor are often frail and delicate operation subjects and, when operation is absolutely indicated and is the ultimum refugium, the mortality here is rather high. As indicated in the table, three died from pneumonia, one from pulmonary embolism, one from

TABLE I

Operations for Brain Tumor	79	Operations for Exophthalmic Goiter	199
Deaths after Operation	20	Deaths after Operation	14
From the Brain Tumor (2 weeks after operation)	1	Acute Post-operation Hyperthyroidism	8
Pneumonia	3	Pneumonia	4
Pulmon. Embolism	1	Uncertain Cause of Death	2
Coma Diabetica	1		
Infection	2		
Hæmorrhage into the Tumor Cavity	1		
Too Bad General Condition or Uncertain Cause	11		
Operations for Gall-Stones	457	Operations for Appendicitis	2192
Deaths after Operation	54	Deaths after Operation	75
Brain Apoplexy	1	Peritonitis	45
Pneumonia	10	Ileus by Adhesions	7
Pulmon. Embol. Thromb.	12	Perforating Distention Ulcer	1
Cholemic Hæmorrhage	2	Phlegmon of the Stomach	1
Peritonitis	6	Cardiosclerosis	1
Hepatic Abscess or Cholangitis	3	Pneumonia	9
Acute Pancreatitis	4	Pulmon. Embolism	9
Probably Insufficiency of Liver	7	Pulmon. Tbc.	1
Acute Dilatation of Stomach	1	Hæmophilia	1
Surgical Technical Causes	2		
Bad General Condition	1		
Uncertain Cause	5		
Kidney Operations	266	Prostatectomy	170
Deaths after Operation	24	Deaths after Operation	22
Tbc. Meningitis	1	Acute Psychosis	1
Pulmon. Tbc.	1	Cardiosclerosis	1
Myocarditis	2	Pneumonia	5
Pneumonia	1	Pulmon. Embolism	2
Pulmon. Embolism	2	Surgical-Technical Cause	1
Post-operative Hæmorrhage	2	Hæmorrhage (Mainly)	3
Infection	2	Infection	3
Uræmia	8	Pyelonephritis, Uræmia	6
Parotitis	1		
Tumor-Cachexia	1		
Complic. Disease	3		

diabetes, one probably from hæmorrhage as proximate cause and two from infection (in one case with tamponade for severe, stubborn hæmorrhage and death from meningitis after eight days; in the other case with leakage of cerebrospinal fluid into the wound and deaths after three and one-half weeks). No fewer than nine of the other cases died within three days after the operation: a boy of nine years with glioma of the cerebellum died on the

operating table, four others died within one day and five on the second and third day. Several of these patients were dull and debilitated before the operation and were too bad for even palliative surgical treatment, others died rather suddenly and unexpectedly, *e.g.*, two after extirpation of an auditory nerve tumor. The chief post-mortem finding in the non-radically operated cases was usually the brain tumor itself, sometimes a more or less intensive internal hydrocephalus, sometimes a certain degree of hæmorrhage in the region of the operation, the import of which was often difficult to judge. At autopsy of these cases it often proved troublesome to determine the causes of death.

The table shows 199 *strumectomies for exophthalmic goitre* with fourteen deaths: eight of them in acute post-operative hyperthyroidism (during the last four years we have had four such deaths, despite the fact that these years practically all the serious cases of exophthalmic goitre had been pre-operatively treated with Lugol's solution). In four cases the cause of death is pneumonia, although local anæsthesia was invariably used. In two cases the cause is rather uncertain.

Next we find 457 *operations for gall-stone* with fifty-four deaths. Pulmonary embolism and pneumonia play here a very large part as cause of death (in twenty-two cases); peritonitis figures prominently in the severe cases of cholecystitis with possible perforation (in six cases). In four cases the causes of death was concurrent acute pancreatitis. Several deaths in the gall-stone group must, despite necropsy, be denoted as uncertain; some of the cases diagnosed as "Probably Insufficiency of Liver" are also rather uncertain. We lose here and there complicated gall-stone cases after operation, especially debilitated patients with icterus, where we cannot determine why the patient dies.

The *appendicitis material* comprises 2192 cases with seventy-five deaths, *i.e.*, a mortality of 3.4 per cent. (within this group the figures are so large that computation in percentages is justified). Peritonitis is as a matter of course the main cause of death (in forty-five cases). Next come pulmonary embolism and pneumonia with nine deaths each. Further there are here a number of cases with ileus by adhesions where we were unable to pull the patient through.

The table shows 266 *kidney and ureter operations* with twenty-four deaths due to rather varying causes. Uræmia represents the largest group (most of these were in a uræmic condition before the operation). The lung complications play a rather insignificant part as cause of death within this group.

One hundred and seventy *prostatectomies* for prostate hypertrophy have twenty-two deaths. As the table shows, the principal causes of death are pyelonephritis and uræmia, pneumonia, infection and hæmorrhage. Pulmonary embolism has here only two cases to its account.

The total number of post-operative deaths at the Lund Surgical Clinic during the seven-year period 1922–1928 was 856. In Table II, below, these 856 cases are distributed among nine different groups. As will be seen, the

table with its grouping is not drawn up on any uniform logical principle, but purely according to practical clinical conditions.

As a commentary to the table it may be mentioned that Group 2, "Bad General Condition," contains all cases where the bad general condition of the patient, senile marasmus, intense arterio- or cardiosclerosis, myocarditis, diabetes, tuberculosis or concurrent malignant tumor in the case of patients operated on for other complaints, for bad Basedow condition, etc., was the *main* cause of death.

Under the head "Technically Faulty or Incomplete Operation" are included, besides the cases where surgical faults had manifestly been committed, such cases as those where autopsy showed that an operation performed in another way would have probably given a successful result.

As regards the group "Post operative Infection"—a serious group for surgery and surgeons—it may be remarked that nineteen out of the thirty-

TABLE II

Cause of Death	1922	1923	1924	1925	1926	1927	1928	Total
1. Primary Disease or the Lesion Itself	53	48	55	55	56	49	66	382
2. Bad General Condition	11	5	11	14	13	9	12	75
3. Errors in Diagnosis, Incorrect Expectant Treatment	1	—	4	1	2	1	2	11
4. Technically Faulty or Incomplete Operation	5	11	5	4	2	7	3	37
5. Post-operative Infection	7	4	7	4	3	4	3	32
6. Special Post-operative Complications	5	16	12	13	17	10	8	81
7. Pneumonia, Pulmon. Abscess, Bronchitis	18	20	25	19	26	17	20	145
8. Pulmonary Embolism, Thrombosis	16	5	7	10	17	12	11	78
9. Uncertain Cause (often despite autopsy)	3	1	—	5	3	2	1	15
Total	119	110	126	125	139	111	126	856

two cases belonging here have reference to resections or anastomoses on the stomach, mostly for cancer ventriculi, or on the intestine, often for cancer coli. The remaining thirteen operations where I have considered that post-operative infection ought to be recorded as the chief cause of the unsuccessful issue—sometimes the cases are rather complicated and several circumstances have coöperated to this result, eight of the cases are patients with malignant tumor—are as follows: Two cases of trephination for brain tumor (in one of these a cerebrospinal fistula after the operation), two resections of the lower jaw for cancer, one extirpation of large ulcerated epithelioma on a senile person, one cholecystectomy with long complicated after-course, one exploratory laparotomy for inoperable high rectal cancer (uncertain how far peritonitis or intestinal obstruction is more responsible for exitus; no autopsy), one cancer-recti amputation, one bilateral exploratory kidney operation on child with renal tuberculosis, one sectio alta and subsequent urethrotomy in a complicated case, one sectio alta for a large infiltrating and decomposing cancer-tumor of the bladder, and two prostatectomies.

Under "Special Post-operative Complications" are included such dissimilar conditions as acute psychosis, cerebral hæmorrhage, tubercular meningitis, diphtheria, gastric ulcer or cholemic hæmorrhage, liver insufficiency, circulus vitiosus, acute diltation of stomach, post-operative ileus, pyelonephritis, uræmia, etc.

A comparison of the figures tabulated for the different years will show that although the deaths certainly distribute themselves among the different groups with a certain variation, yet on the whole they do so with a certain uniformity year after year, *e.g.*, the annual number of post-operative deaths in pneumonia and from pulmonary embolism. The pulmonary embolism mortality is relatively high in our Lund material, seventy-eight deaths during seven years, *i.e.*, a yearly average of eleven (on about 2000 operations). A comparison with the figures given in my previously mentioned paper from 1912 shows that the number of post-operative deaths from pulmonary embolism has increased at our Clinic during the last fifteen to twenty years.

TABLE III

Cause of Death	1922	1923	1924	1925	1926	1927	1928
Primary Disease or the Lesion Itself (1 in Table II)	46%	44%	44%	46%	41%	45%	53%
Unsatisfactory Indications for Operation (2–3 in Table II)	10%	5%	12%	12%	11%	9%	11%
Unsatisfactory Operation or Special Post-operative Complications (4–6 in Table II)	15%	28%	19%	18%	16%	19%	11%
Post-operative Pulmonary Complications (7–8 in Table II)	29%	23%	25%	24%	32%	27%	25%

If, to get a better collective view, the different causes of death recorded in Table II are assembled into four large groups—which, however, will be rather schematic in certain points—and the post-operative deaths with a known cause, computed in percentages for each year, are divided among these four groups, Table III is obtained.

The percentage figures in this synoptical table show certain variations for the different years, but in the main exhibit good, in part surprisingly good, agreement. This table discloses that during these last seven years at the Lund Surgical Clinic *almost one half* (mostly 44–46 per cent.) *of all the patients that succumbed after operation had died from the primary disease or the lesion itself or some complication of it.* For these deaths surgery can hardly ever be held responsible. Out of the other half more than one half, *i.e., more than one fourth* (mostly 25–29 per cent.) *of the operation cases ending fatally, died from pulmonary complications: pneumonia and pulmonary embolism.* The remaining cases, *i.e., fully one fourth of all the operative deaths* (mostly 25–30 per cent.), fall more immediately or directly to the account of surgery, having been due to *inaccurate or debatable indications*

—the patient has for instance been in too bad a condition for the operation undertaken—*or to faulty technic or incomplete operation or to some special intercurrent operative complication.*

The question of the possibility and prospects of forcing down the number of post-operative deaths is manifestly a wide and important subject within present-day surgery, and one that concerns and is bound up with many different circumstances. On this point just a few words: With respect to the large group where the primary disease or the lesion itself is the lethal cause, it is a matter of course that injuries endangering life and, for instance, hopeless septic conditions will always occur. It should, however, be possible to get the mortality within this group reduced, at any rate to some extent, by improving the knowledge of the public itself in respect of certain morbid states, by laying still greater stress, in our training of medical aspirants, on the prognostic value of *early* diagnosis and *early* surgical treatment of certain diseases, as also by a good and intimate coöperation between medical practitioners and the surgical hospitals.

As regards the groups "Unsatisfactory Indications for Operation" and "Unsatisfactory Operation or Special Post-operative Complications," much will naturally depend on the individual surgeon's experience, knowledge, scrupulousness, judgment and technical skill, but we may also, more objectively, set certain hopes on an improved and more reliable study of organic function and on physiological investigations of possibly existent metabolic derangements, at least for *certain* groups of patients, preliminary to the proposed operation.

Most dismal of all at present is the group "Post-operative Pulmonary Complications" and here particularly pulmonary embolism. At most surgical clinics all over the world pulmonary embolism has probably occurred with increased frequency during the last twenty-five years. The often quite unexpected and unforeseeable occurrence of deaths from pulmonary embolism, their increased number and our, in the main, helplessness in the face of them, both prophylactically and therapeutically, make pulmonary embolism the greatest crux of present-day practical surgery.

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PULSATING EXOPHTHALMOS *

By John M. Hanford, M.D., and John M. Wheeler, M.D.
of New York, N. Y.

Able publications on the subject of pulsating exophthalmos have appeared since Benjamin Travers [1] reported the first case in 1809. Attempt is not made here to trace the history and the bibliography to the present, but to report another, a very interesting type of case, which may serve as a basis for analyzing our knowledge as it applies to treatment.

In 1908, de Schweinitz and Holloway [2] found that 313 cases had been recorded during the first 102 years, and added sixty-nine more. Sattler's [3] report, comprehensive and complete, brings the review up to 1920. Locke,[4] in 1924, adds 131 cases. Jennings [5] in 1927 found 596 cases recorded, including one reported by himself. Since Jennings' article, we have been able, after careful search, to add twenty-one more cases, including five reported by one of us (Wheeler [6]), bringing the total number recorded in all languages, including our own case, to 617. The latest one recorded prior to our own, is that of Scotti [7] in March, 1929.

The average number of cases per year reported throughout the literature since 1813 is about five. Thus the disease is rare, yet one which the general surgeon nearly always, whether it be spontaneous or traumatic, is called upon to treat.

The details of treatment are by no means commonly accepted and so it is important that all cases be reported both to stimulate early diagnosis and to approach standard treatment.

The case which is the occasion of the preparation of the following paper was observed in the period between March, 1929, and March 1, 1930. Its origin was traumatic, having been due to a fracture of the skull producing an arterio-venous communication between the right internal carotid artery and the cavernous sinus, culminating in an acute glaucoma. The treatment was first, digital compression of the right common carotid artery producing complete occlusion, and later, compression of the left, with partial occlusion becoming complete, and later enucleation of the right eye for glaucoma with result of apparent cure.

Case.—L. G., age forty-four years; single. Past history essentially irrelevant except that for some time she has occasionally had blurring of vision in the right eye, not corrected by glasses. Ophthalmologists have thought that this eye symptom was due to infection of ethmoid, sphenoid and frontal sinuses. At the time of her accident, she was about to undertake a further study of the sinuses, although recently she had not been especially troubled with catarrh. Her physician reported that she had had a rheumatic heart, probably with mitral stenosis, but not serious.

On the morning of March 18, 1929, about 9 o'clock, she was struck by a truck on

* Read before the New York Surgical Society, March 12, 1930.

the street, receiving injuries to her head and left shoulder. She became unconscious for a short time; was taken to a drug store, whence she was removed by ambulance to the Presbyterian Hospital and first examined at 11:30 A.M. She had vomited before arrival and complained of nausea, headache, dizziness, pain across the eyes and across the back of left shoulder; and felt chilly. She had bled from her nose.

The combined physical examination of Dr. Charles A. Elsberg and the surgeon revealed an essentially healthy looking woman, rather pale but quiet and resting on her back. The surface was moderately cold, the eyes were closed with the upper lids prominent and purplish in color. The right eyeball protruded slightly and there was subconjunctival hæmorrhage. The pupils were equal, reacting sluggishly to light and accommodation. The movements of the eyeball were good in all directions. The fundi appeared normal with arteries and veins of normal size without hæmorrhages.

FIG. 1.—Patient before operation.

FIG. 2.—Patient before operation.

There was an abrasion on the left temporal region with marked swelling and œdema and a large hæmatoma over the left parietal region giving a central depression. A cracked-pot sound was not obtained. Fresh blood appeared in the external nares and in the mouth. The tongue protruded in the median line. There was no facial paralysis. The blood-pressure was 144/90. Pulse 80. Temperature 98.8°. Respirations 28. The heart and lungs were made out normal. There was tenderness over the spine of the scapula but no other evidence of fracture was found on the primary examination. The power in all her limbs was good and equal. The upper extremity reflexes were normal and equal. The lower extremity reflexes were also normal and equal except that the right Achilles was the more active. Abdominal reflexes, normal and equal. The cranial nerves were made out normal and there was no disturbance of sensation except over the left side of the head, which was tender.

Tentative Diagnosis.—Fracture of the left side of the vault and of the base of the anterior fossa of the skull. Fracture of the spine of the scapula. No evidence of gross intracranial lesion.

The patient was carefully watched, treated symptomatically, the left arm bandaged to her side and that evening, a catheterized urine specimen showed little albumin and a few casts.

The next morning she felt better but had bad headache and pain in the left shoul ler and arm.

Three days later there was marked swelling and protrusion of the conjunctiva in the upper and lower lids of the right eye with much pain in the right eye. At this time, examination by Doctor Wheeler was stated as follows:

"Exophthalmometric readings: right 22 millimetres; left 20 millimetres. A bruit synchronous with the pulse can be heard anywhere on the head or face, perhaps loudest in the temples. It can be heard distinctly over both globes. I could not convince myself that it was more distinct on the right side than on the left but subjectively it is heard only on the right. Patient has been conscious of a 'swish' with her heart beats during the past two or three days but it has not bothered her. In my opinion there is an arterio-venous communication in the cavernous sinus. I should expect the proptosis to increase and the symptoms to become more pronounced. Ligation of the common carotid artery and the creation of adhesions between the right upper and lower eyelids might be considered. I suggest compression of the right common carotid artery."

One week after the injury, the patient was very ill, with vomiting, anorexia, pain in the right orbital region and the sense of pulsation in the right side of head.

On this day marked pulsation of the right eyeball, synchronous with the heart beat, was detected on palpation and inspection. The bruit was still heard equally on both sides. On compression of either common carotid singly no decrease of the bruit was heard; but when both were compressed simultaneously it decreased.

On the same day, Dr. Charles A. Elsberg found the cornea sensitive to cotton; the pupil reacting sluggishly to light but the contraction not sustained. He also found no influence upon the pulsation of the eyeball by compression of the right carotid. He also concluded that the patient had an arterio-venous communication.

He felt the outlook gloomy unless a clot should form either spontaneously or after ligation. He felt the outlook for improvement after ligation of the right carotid was not good because of the fact that the pulsation continued even after compression of the vessel.

Three days after the injury, Dr. Ross Golden, röntgenologist of the Presbyterian Hospital, reported a transverse fracture of the left acromion process without displacement, a comminuted fracture of the neck of the scapula. The following ribs were fractured: the second, third, fourth and fifth on the left side. Films of the skull showed no evidence of fracture in the left temporo-frontal region. "The fracture line rises out of the floor of the anterior fossa. Another line appears to run upward and then downward through the margin of the orbit. The nasal bone appears to be fractured. The upper margin of the right orbit appears irregular but I am not sure that it was fractured. The right ethmoid region appears quite opaque as if there might be hæmorrhage in the cells."

April 5, nineteen days after the injury, the patient presented an increasingly distressing condition with headache every morning, extreme dryness of the mouth, absence of smell and taste, pain in right orbital and temporal region and a continuation of the exophthalmos, pulsation, "swish" and bruit. The bruit was not high pitched. She was completely dependent upon sedatives even for slight relief of distress. On this day, it was found that compression of the right common carotid artery caused disappearance of the subjective "swish," of the objective bruit and of the pulsation. After consultation, it was finally determined that a definite step in treatment should consist of a few days of digital compression followed by careful ligation of this artery.

April 15, twenty-nine days after the injury.—During the preceding ten days, digital compression of the artery against the carotid tubercle was made by the day nurse beginning with five minutes and gradually increasing to fifteen minutes three times a day.

It apparently caused no unfavorable symptoms; yet the patient had become worse with vomiting, dehydration, thirst, dizziness, headache, photophobia and depression. There was paralysis of right external rectus muscle. On this day the right common carotid artery was ligated under local anæsthesia. One per cent novocaine was used to block the cervical plexus according to the technic of Labat and local infiltration into the site of operation. Local infiltration was used in the right thigh for the removal of a strip of fascia lata.

Procedure and Findings.—The artery was about .75 centimetres in diameter. After isolation of the artery, a small guarded clamp was applied slowly and left on for some thirty-five minutes, during which time Doctor Wheeler heard but a faint bruit, almost imperceptible, and no new symptoms were felt by the patient. It was agreed therefore that complete ligation was indicated and probably safe because of her relative youth, of the elasticity of the artery and because of the fact that very soon, if not then, a complete ligation would almost certainly be needed. During the operation the patient complained of thirst and especially of pain just below the right mastoid.

A six-centimetre oblique incision was made along a crease in the neck about opposite the upper border of the thyroid cartilage and deepened through the superficial layer of the deep fascia. An upper and lower flap were reflected and the sternomastoid muscle retracted backward. The carotid sheath was entered when the ansa-hypoglossi appeared. This was pushed upward and the vein retracted backward. The vagus nerve was easily avoided. The artery was gently elevated by means of a small right-angled ligature carrier.

While the clamp was in place a strip of fascia from the thigh, twelve centimetres long and one centimetre wide was removed by the Gallie technic. Part of this was then passed once around the artery and fixed to itself with three fine chromic sutures. It was then passed again and snugly fixed and finally a third time around and again sewed snugly around the artery. Redundant fascia was cut way. Difficulty was encountered in making the circular application of the fascia sufficiently tight to obliterate the pulsation. It almost succeeded but not quite. As a final step therefore, a doubled No. 2 chromic ligature was tightly tied around the artery just above the fascia; that this obliterated the lumen was proven because pulsation could not be felt above it, because the patient ceased to hear the "swish" and because the bruit became almost imperceptible. A small tube was left in the neck wound for oozing, to be removed next day.

The operation was done with deliberation in order to be fully observant of the effects of complete occlusion before the final ligature.

Three days after the operation: severe headache, probably due to brain anæmia; blood-pressure, low. "Swish" not felt by patient since operation. Bruit very faint. No visible pulsation but on deep pressure, faint pulsation of the right globe is felt. Exophthalmometer: right 21 millimetres; left 16 millimetres.

Seven days after operation, Doctor Elsberg found distinct left lower facial weakness of supranuclear type. The tendon reflexes in the left upper and lower extremities were more active than those on the right. There was double inexhaustible ankle clonus and double Babinski and Chaddock signs. These signs meant either increase of the size of the aneurism or a secondary softening in the right cerebral hemisphere.

Ten days after operation, Doctor Wheeler found less deviation of the right eye and improved motility. The veins of the globe were still dilated but no dilatation of veins of the lids. The bruit was much more distinct over the right globe than elsewhere and it seemed louder in the temple than during the first few days after ligation. Exophthalmometer: right 21 millimetres; left 18 millimetres.

April 28, thirteen days after operation, the "swish" again was felt. She was vomiting daily. Both eyeballs appeared more prominent and the bruit was again very loud.

Digital compression of the left common carotid artery almost, if not completely, eliminated the bruit. Compression of the left carotid was started April 27, twelve

days after the operation on the right, five minutes three times daily, increased five days later to ten minutes.

May 2, seventeen days after operation, ophthalmoscopic examination revealed slight dilatation of the retinal veins of the right eye with no other abnormal findings in the eye grounds.

May 4, nineteen days after operation, observations of Doctor Elsberg: "The left facial paralysis persists. The tendon reflexes in the left upper and lower limbs are still more active than those on the right; the double ankle clonus is now not as well sustained and easily exhaustible. Babinski and Chaddock signs still are present though less marked on the left but not elicited on the right side."

Conclusion.—The disturbances due either to the arterio-venous aneurism itself or secondary to the ligation of the carotid on the right are much less marked and the

FIG. 3.—After operations. Artificial eye. Note scars in neck.

FIG. 4.—After operations. Artificial eye. Note scars and enophthalmos.

right cerebral hemisphere is again adequately supplied with blood. Unfortunately the bruit has returned. Compression of the left carotid for five seconds caused an increase of the pain in the right side of the head, but the bruit to be heard over the right temporal region promptly disappeared. At present, careful compression of the left carotid for increasing periods was thought to be all that was permissible. If the slightest cerebral symptoms should occur during a period of compression, this was to be stopped at once.

May 19, 1929, thirty-four days after operation, observations by Doctor Wheeler: "Right eye: Eyelids; slight dilatation of veins. At margin of upper lid is a little varicosity. No œdema. Conjunctivæ: Veins markedly dilated. Pupil: slightly dilated and irregular in shape. It does not react to direct light. Movements: Considerably improved but still limitation of abduction. Interior: Retinal veins greatly dilated. Many hæmorrhages into retina, especially along dilated veins. No œdema. Left eye grounds normal. Exophthalmometer: right 20 millimetres; left 17 millimetres. Last evening

for the first time, the patient heard a musical squeaking sound which was timed with the pulse. The bruit can be heard faintly in the right temple, surely not as loud as at my last examination though still loudest over the right globe."

June 15, two months after the right ligation: The patient was miserable with headache, depression, occasional hysteria and dependent upon codeine and morphine. The "swish," or subjective bruit, was but rarely sensed and not a distressing symptom. The bruit was very distinctly heard, especially over the right globe. The conjunctiva of the right eye was œdematous and protruding, and the veins more dilated. The retina had more hæmorrhages. Central vision was involved by the hæmorrhages. The sixth nerve paralysis persisted. In the left eye, the veins of the bulbar conjunctiva were slightly dilated but this eye was otherwise normal.

Since the patient was in a most distressing state and not improving, despite a long period of left carotid compression, partial ligation of left common carotid artery was then decided upon.

June 19, 1929. *Operation.—Partial ligation of the left common carotid artery.* Novocaine was used for block and local anæsthesia. An obliquely transverse six-centimetre incision was made about at the level of the upper border of the thyroid cartilage in a natural crease opposite the right scar. The same technic was used as on the right side for exposure and delivery of the artery. A strip of "Baer's Membrane" (chromicized pig bladder) one-half centimetre wide was passed around the artery three times, securing it each time with very fine chromic catgut. The diameter of the artery was thus decreased by more than one-half and the pulsation above the partial occlusion was definitely less intense than that below. The membrane was friable so that the security of the ligature was doubted. Therefore over the membrane, a strand of No. 2 chromic catgut was tied but not sufficiently tight to increase the obliteration of the lumen. It was used merely for reinforcement. The wound was closed in layers without a drain.

During the ligation, careful observation was made to determine any subjective or objective signs of interference with the intracranial circulation. None were noted. The operation was done deliberately over a period of a little over an hour.

July 7, nineteen days after left carotid ligation: The headache and "swish" and bruit were less than at any time since before this operation. The headache was of a different type; in the top and back of the head, and she had nervousness, restlessness, emotionalism. It appeared that her symptoms might well be due to the withdrawal of morphine and codeine used for so many weeks. The eyeball did not pulsate. It was but faintly prominent so that the patient no longer had "pulsating exophthalmos" but had a faint bruit. Paralysis of the sixth nerve, congestion of the conjunctival vessels and faint vision in the right eye persisted. Pulsation in the neck, above the site of recent ligation of the left carotid could not be felt, so it was assumed that the left ligation had spontaneously become a complete occlusion.

July 20, thirty-one days following left carotid ligation: Codeine and morphine had not been used for more than two weeks. The past four days and nights had been very comfortable with little headache, limited to the vertex and occiput—no right eyeball headache. She was eating well. Her functions were essentially normal. She walked about the hospital and out of doors though somewhat unsteady on her feet. Simple sedatives were required for sleep and for the slight headache. Paralysis of the sixth nerve had disappeared, a good prognostic sign of the reduction in the size of the aneurism. She felt no "swish" and no bruit was heard anywhere except perhaps faintly over the right globe. No abnormal neurological signs were found. Exophthalmos and pulsation were now absent. There was dark red discoloration of the conjunctiva due to chronic passive congestion of the scleral vessels. The left pupil was normal. The right was irregular, pear-shaped, almost fixed. There was diplopia probably due to muscular weakness of the right eye. She read with the left eye and when awake wore spectacles with the right glass darkened. No pulsation was felt in either side of the

neck above the site of ligation, so it was assumed there was complete occlusion of each common carotid artery. Her spirits were good. Blood-pressure and urine remained normal.

Observations of Doctor Wheeler: "Exophthalmometer: right 20 millimetres; left 20 millimetres. In the right eye, dilatation of the veins of the bulbar conjunctiva persists. Pupil, as stated above. The fundus of the right eye shows no new hæmorrhages, with previous hæmorrhages in various stages of absorption. The patient can move the right eye a little beyond the mid-line in 'eyes right.' The bruit can be heard faintly over the right globe but nowhere else. No pulsation of the globe. The left pupil reacts well."

July 20, four months following the injury: The patient leaves the hospital with a trained nurse to visit in the country.

August 23, five months from the injury and about two months from the second ligation: The patient was returned on a stretcher to the hospital. She had done well for one week following her discharge when she began to have pain in the right eye, becoming very acute. A short time afterwards, she was seen by Doctor Wheeler, who made the diagnosis of acute glaucoma of the right eye. Despite the use of eserine and hot compresses, the tension of the eye could not be controlled and the pain became increasingly severe. Her condition on re-admission was that of marked prostration and stupor from large doses of morphine.

At this time, Doctor Kirby was asked to assume charge of the patient because of Doctor Wheeler's absence from town. His observations on her re-admission were as follows:

Right eye: congested conjunctival and deep vessels. Cornea hazy with œdema of its epithelium. Anterior chamber shallow. Pupil dilated and immobile. Interior not visible because of the haze of the media. Increased intra-ocular tension. Tension of right eye, 40; of left, 12. Exophthalmometer: right 23 millimetres; left, 25 millimetres.

Left eye: considerable chemosis of palpebral conjunctiva inferiorly. Congested conjunctival vessels. Cornea clear. Anterior chamber shallow. Iris clear. Pupil small but no reaction. Interior not seen. No bruit heard over either eye. No pulsation of eyeball and no "swish" has been heard by the patient since leaving the hospital.

Treatment.—Eserine 1 per cent every two hours; boric solution and hot compresses and symptomatic treatment.

On the same evening, on account of intense pain, Doctor Kirby performed a paracentesis of the right cornea. Aqueous humor escaped slowly, lowering intra-ocular tension. Temperature, pulse, blood count and urine essentially normal.

August 27, on account of persistent pain, and of intra-ocular tension and because the organ was hopeless for recovery of vision, we advised removal of the right eye.

August 28, Doctor Kirby, with local anæsthesia, enucleated the right globe. Pathological report upon the eye reveals nothing significant nor unusual.

September 6, nine days following the removal of the eye, Doctor Kirby reported that the left eye was as follows: Exophthalmometer 0.5, 22 millimetres, at 92. Fundus examination, marked cupping of the disc (physiological). Veins, moderately full. About one disc diameter from the margin of the papilla is a greenish-brown area suggesting an old hæmorrhage; but no suggestion of recent or old hæmorrhage elsewhere.

February 19, 1930: In October, the patient was fitted with an artificial eye and since that time has been comfortable and well in every way except for the absence of smell sensation, very faint taste sense and lack of normal energy. Her general habits and functions are essentially normal. Her weight is below what it used to be. She has no sensation of a "swish"; no bruit is heard and there is no pulsation in either eye. The right eye shows recession or enophthalmos. There are no neurological findings. The external jugular veins pulsate quite markedly with the heart beat. She is now doing part-time work and does a good deal of reading.

Discussion.—The diagnosis of pulsating exophthalmos was established by the cardinal features, subjective and objective bruit, exophthalmos, and pulsation of the eyeball.

It is not positive that there was an arterio-venous communication though this is the most probable lesion. Against it are the absence of a whistling type of bruit, of gross distention of the veins of the orbit, and of marked exophthalmos. In this case, the lids did not need surgical closure to prevent extreme protrusion. Blood from a nearby vein was not obtained for its oxygen content. This would have been the only positive evidence. It would be interesting, on future cases (and an easy step) to obtain a sample of blood for oxygen content from the internal jugular vein at the time of operation.

It may be that this patient had merely a simple aneurism of the internal carotid in the cavernous sinus.

It is noteworthy that at first only bilateral carotid compression decreased the bruit, whereas, twenty-nine days after the injury, before either operation, compression of the right obliterated it entirely. Thus, perhaps, some degree

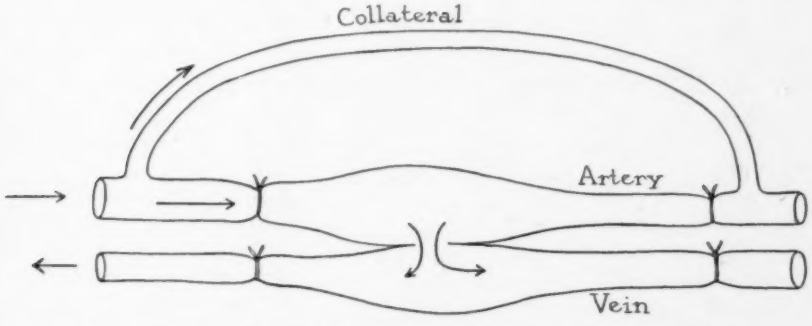

FIG. 5.—Quadruple ligation in arterio-venous aneurysm of an extremity.

of spontaneous obliteration of the aneurism had occurred. This finding increased the chance of improvement by ligation.

The pre-operative compression was easily made by a nurse, guided by the effect upon the "swish" and instructed how to suspect trouble. It caused little discomfort to the patient, although an added annoyance. The artery was compressed backward and inward against the transverse processes.

In the first operation (on the right side), simple wrapping of the fascia lata about the vessel was not difficult but tightening was awkward and indeed failed of occluding the vessel completely. Tying one or more thin fascial strips about the artery would have been easier and just as effective in providing a secure, permanent, occluding substance. The fascial wrapping plus the chromic ligature evidently worked well enough in this case.

The right carotid occlusion was followed by a slight degree of damage (probably a narrow escape) to the right cerebrum. There was none noted following the left ligation, which, however, was at the start only a partial occlusion. In the second (the left) operation, "Baer's Membrane" offered the same trouble of securing it after it had been wrapped about the vessel.

It was not only difficult but too friable to fix securely. This substance does not appear to be suitable to be used as a tied ligature. Complete occlusion occurred in the left artery and was noted, first, eighteen days after the partial occlusion by the "Baer's Membrane."

Acute glaucoma is not a common, but a recognized sequel of this disease. While the loss of the affected eye is deplored, the patient is fortunate in having a good remaining eye.

The patient has been cured, apparently, and has been comfortable since September; now about five and one-half months. The injury was nearly a year ago.

The main interest in the treatment of a pulsating exophthalmos centers around the dangers of carotid occlusion.

A few cases are reported as resolving spontaneously and a few following simple arterial compression. A few have responded to operation limited to the orbital vessels in which there is no essential danger. But the great majority of patients go unrelieved without partial or complete occlusion of the common or of the internal carotid artery, of one or both sides.

The dangers are mainly two-fold; either death or permanent cerebral damage, such as hemiplegia, partial or complete. Writers vary, but one might state fairly that there is about 10 per cent. mortality and in those that survive, 10 per cent. morbidity. Damage is due to failure of adequate collateral circulation which is mainly through the circle of Willis. Arterio-sclerosis increases the dangers and so generally speaking, the younger the patient, the less the danger.

The factors tending to minimize these dangers of occlusion are mainly complete rest in bed, a period of pre-operative compression of the common carotid artery and some method of partial or of gradual complete occlusion. Recently, Holman [8] has emphasized the added safety of combining internal jugular vein ligation with carotid occlusion for arterio-venous communication.

The surgeon confronted with the problem of operative treatment must decide certain points.

A. The selection of the vessel or vessels to be occluded.

The common carotid has been the one most frequently used and many successful cases have been recorded following its use. A few successful bilateral occlusions of this artery are also on record. There are some theoretical disadvantages in the use of the common as compared with the internal carotid artery. The external carotid artery has a free anastomosis with its fellow of the opposite side which may result in a retrograde stream down the external carotid and up the internal carotid on the side on which the common carotid is occluded. If this occurs then the aneurism again becomes subject to refilling through the original route. The common carotid being a larger artery requires more substantial means of occlusion. Conversely, a ligature is more likely to give way before the pressure and fail to occlude or on the other hand to cut through to cause secondary hæmorrhage.

The most telling evidence against the common carotid and in favor of the internal are the statistics of Sattler [3] and of Locke.[4] In searching the records they, independently, found better results following ligation of the internal carotid artery. Grouping spontaneous and traumatic cases of pulsating exophthalmos together, Sattler found that after primary ligation of the internal carotid 67 per cent. were cured and 83 per cent. cured or improved, while with the common carotid only 46 per cent. were cured and 64 per cent. cured or improved. Locke's statistics of cases from 1907 to 1924 are almost the same. Admitting that fewer cases of internal carotid ligation were recorded, still the difference in results is striking.

The studies of Holman,[8] both clinical and experimental, indicate that the best treatment for arterio-venous communication, in an extremity, is ligation of the artery and vein both proximal and distal to the lesion, followed by its excision. This complete procedure is impossible in the cranium but it is logical to suppose that the nearest approach to it would give the best results. The diagrams show the ideal plan of treatment in the simple anatomy of a limb compared with the complex anatomy of a lesion in the cavernous sinus. The nearest approach to the ideal in the latter condition might be, theoretically, as follows:

Proximally.—Ligation of the internal carotid artery and of the internal jugular vein.

Distally.—Ligation of the superior ophthalmic vein and of the ophthalmic artery.

In patients with distended orbital veins, ligation of the superior ophthalmic vein is generally conceded to be a very helpful procedure. If not distended, orbital vein ligation is probably not helpful. The ophthalmic artery is probably too inconsequential as compared to the circle of Willis to make its ligation worth while.

One may logically conclude, therefore, that the vessels to be occluded in a case of arterio-venous communication in the cavernous sinus are the internal carotid artery, and the internal jugular vein; and besides these, at a later stage, in a case with distended orbital veins, the superior ophthalmic vein (usually the superior, occasionally the inferior) should also be ligated. But in a case of simple aneurism of the internal carotid without venous communication, the internal jugular vein need not be ligated, though it would probably do no harm.

B. The method of arterial occlusion.

The easiest and most convenient method of immediate, complete ligation with chromicized catgut has certain disadvantages.

It is not suitable for permanent partial occlusion because after absorption, the artery may resume its full function. This may occur even with complete occlusion by simple ligature, unless the artery be divided. If chromic catgut is used, it is probably best to divide the artery, leaving two ligatures on its cardiac stump. But this implies immediate, complete, irrevocable occlusion,

leaving no means of escape should the signs of cerebral damage appear. This last objection applies to silk and to linen ligatures.

Halsted [9] and his co-workers, in 1905, and through succeeding years, published a good deal of work on the study of arterial occlusion. He became especially interested in the use of rolled aluminum bands. Matas and Allen,[10] in 1911, reported experimental and clinical data relating to the occlusion of large arteries with aluminum bands.

Their basic thought was the danger of immediate, complete, permanent occlusion. They sought means of testing the collateral circulation before final occlusion and also means of releasing the artery when danger threatened.

To be specific, Halsted rolled a band of thin aluminum sheeting two and one-half times round the artery. His idea was thus to produce partial occlusion. Then one of two things ensued. If the signs appeared of failing circulation to the part, the wound was reopened and the band released. If, however, after a few days or more, the circulation appeared adequate, the band was left *in situ* with the hope of gradual complete occlusion by fibrosis; or the wound was reopened to roll the band tighter for complete occlusion.

Matas and Allen [10] advocated a simpler technic in the use of a heavier aluminum band applied like the letter U about the artery. The degree of occlusion desired is controlled by compression of the U. If trouble appears, the wound is reopened and the band widened or, if all is well, the band, at a second operation, may be completely compressed. The metal is stiff enough to remain fixed yet easily manipulated.

Matas and Allen discovered that complete occlusion by their band could continue for seventy-two hours without damage to the intima and without thrombosis. Therefore, three days may elapse for the appearance of trouble with time still to release the artery intact without fear of embolism.

In 1911, Neff [11] reported his special aluminum clamp for gradual occlusion of an artery by a single operative procedure. Two blades are hinged to make a V. The artery rests between the blades which are approximated by rubber bands. The free ends of the blades are held apart by plain catgut wound around and between them. As the catgut absorbs, the blades approximate and compress the artery. Neff, Jennings and others have reported its use with success. In one case, the clamp annoyed the patient on swallowing and later was removed.

Kerr [12] and others report favorably on the use of fascia lata which we used in our patient, on the right side. Kerr practised a two-stage operation, first partial, and later complete occlusion. The main advantage of the fascia lata is that it can be depended upon for continued partial occlusion. It is not absorbed. At a second stage, if desired, completion of the occlusion with chromic will be effective.

Hitzrot [6] stated in 1927 in Wheeler's article, after a trial of chromicized pig's bladder (Baer's Membrane) in six operations to occlude the common carotid artery, that he believed that, in most cases, partial occlusion with

this material became complete in a very short time. This took place in our patient on the side on which Baer's Membrane was used.

In selecting the method of occlusion, we have then, four methods to choose from and several materials available for their fulfilment. They all presuppose pre-operative digital compression.

1. Gradual complete, permanent, arterial occlusion by one operation. This is the best method of all and for its accomplishment the Neff clamp, in the present state of knowledge, offers the best technic available. It may be that an exact adjustment of Baer's Membrane can be worked out to achieve this by a simpler procedure than that of the Neff clamp.

2. Partial occlusion followed, in due time, by a second operation, if needed, to complete the occlusion. This is the next safest method, but will usually require two operations. Here the U-shaped metal band of Matas and Allen appears to stand first. It is easily prepared, easily applied, easily adjusted, and, later, easily compressed to complete the occlusion. Further it is safe, accurate, secure and well-borne by the tissues. The rolled band of Halsted meets the same needs but is more difficult to prepare and to apply. Baer's Membrane and fascia lata are both available for this procedure, chromic catgut being used for the second stage operation. Linen or silk ligature or tape may be successful, followed later by chromic but a circular tie against the arterial pressure may be difficult of fine adjustment for partial occlusion.

In this connection, it should be emphasized that even partial occlusion may need release, and that the Matas-Allen band is of all the occluding agents, the most quickly and accurately released.

3. Complete occlusion which can be released if cerebral damage threatens. This is a bolder procedure and when used, the surgeon assumes that the chance of damage is very slight; but he must be prepared for immediate re-operation and release on short notice. Here the Matas-Allen band again holds first place. It is easily applied, as already emphasized. Its release is most simple, direct and immediate, by means of a knife-blade separating the ends of the U. Matas and Allen found in their excellent studies on the dog and after some clinical evidence, that the intima of the artery is intact for seventy-two hours after the careful application of their band in complete occlusion. This means that if evidence of cerebral damage appears during the first three days after complete occlusion by this method, the artery may be re-opened to function without fear of embolism from a thrombus. No other technic is so susceptible of accurate application and of accurate, quick release.

A few cases have been reported in whom cerebral damage appeared later than the seventy-two hour period. This possibility though remote, casts an imperfection upon the method of complete occlusion with possible subsequent release, because after seventy-two hours, the artery may be beyond recovery and an embolism may occur, if released.

4. Immediate, complete, irrevocable occlusion. This is the least desirable method of all. Any of the materials may be used for its accomplishment.

This was the method employed on the right side in our patient. This method has been the one most commonly used in this disease and many successful results have ensued; but if we are to reduce the mortality and the morbidity, one of the other measures is bound to give better results. These cannot be expected, however, without more care and preparation than is needed for the application of a simple tight ligature. Stimulated by the problems of the case herein reported, one of us (Hanford) practised several dog experiments in arterial occlusion. We used the Neff clamp, the Halsted rolled band and the Matas-Allen U-shaped band. Impressions gained from these few experiments may be stated as follows: The Neff clamp meets the indications better than any other material but its preparation and application require a technic not to be undertaken without considerable study and practice. At least one animal experiment should be made before its application to the human subject.

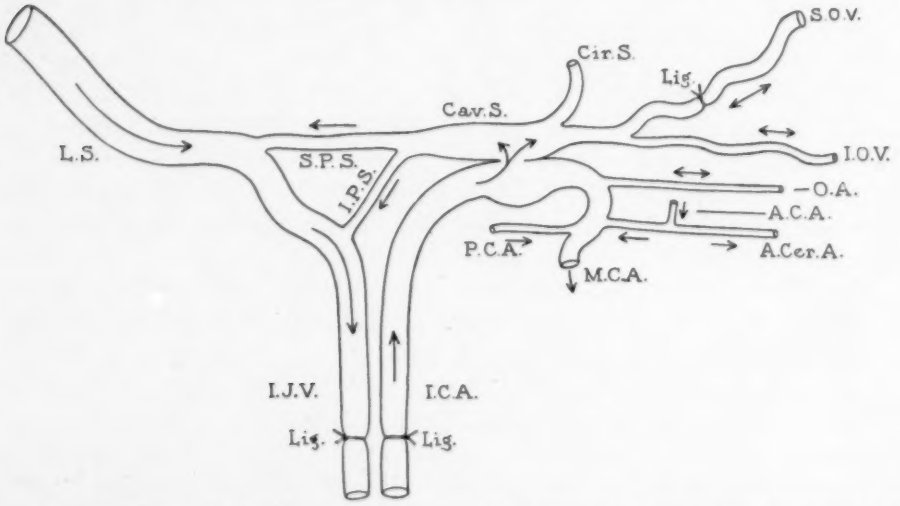

FIG. 6.—Diagram representing arterio-venous aneurysm between the internal carotid artery and the cavernous sinus with occlusion of the internal carotid artery and of the internal jugular vein in the neck and of the dilated superior ophthalmic vein in the orbit. An approach to the quadruple ligation. L.S.—Lateral sinus. S.P.S.—Superior petrosal sinus. I.P.S.—Inferior petrosal sinus. Cav. S.—Cavernous sinus. Cir. S.—Circular sinus. S.O.V.—Superior ophthalmic vein. I.O.V.—Inferior ophthalmic vein. I.J.V.—Internal jugular vein. I.C.A.—Internal carotid artery. O.A.—Ophthalmic artery. A.Cer.A.—Anterior cerebral artery. A.C.A.—Anterior communicating artery. P.C.A.—Posterior communicating artery. M.C.A.—Middle cerebral artery.

The Halsted rolled band of thinner aluminum (about No. 32 Brown and Sharp sheet metal gauge) must be accurately rolled around the artery which is not easily accomplished without practice before one attempts its use on a human artery. Besides this, it is not so very easily released by unwinding. The Matas-Allen U-shaped aluminum band (of No. 20 gauge) is easily prepared, easily applied either for partial or complete occlusion, quickly and accurately released or tightened at a second stage; and indeed is so simple in principle and practice as to require no other preparation on the part of the surgeon than to read Matas and Allen's article and to procure a small sheet of aluminum. It is more easily applied than fascia lata or Baer's Membrane, and also more easily released than these.

CONCLUSIONS

A case of pulsating exophthalmos is reported, a traumatic case without evidence of arteriosclerosis; caused probably by arterio-venous aneurism between the internal carotid artery and the cavernous sinus. The orbital veins were not appreciably engorged. An apparent cure has resulted after bilateral common carotid artery occlusion and after enucleation of the affected eye for persistent acute glaucoma.

The treatment for such cases may be outlined as follows:

1. Complete rest in bed, maintaining nutrition and using sedatives as needed.

2. If exophthalmos exposes the cornea or threatens evisceration, the lids should be approximated by suture through a special technic of eye surgery.

3. A period of digital compression of the common carotid artery with constant watch for signs of cerebral damage. It should be continued long enough to give it a fair trial as a means of cure by itself, and long enough to insure the safety of partial arterial occlusion by operation.

4. Operation, with regional block and local anæsthesia, through an obliquely transverse incision, to apply to the internal carotid artery of the affected side a Matas-Allen metal band for partial occlusion. At the same time the internal jugular vein is ligated. The patient is carefully watched for evidence of brain damage.

5. The indications for the orbital operation consisting usually of ligation of the superior ophthalmic vein have been stated by Sattler [3] and others to be:

(*a*) Distention of the orbital veins.

(*b*) When compression of the orbital veins obliterates the bruit.

(*c*) When carotid occlusion is contraindicated and its compression has failed.

(*d*) When carotid occlusion is followed by failure or recurrence, and the orbital veins are distended or their compression obliterates the bruit.

(*e*) It is best done after complete carotid occlusion of the affected side, before operation upon the opposite carotid.

Sattler also gives the following contraindications to the orbital operation. It is not to be done when the orbital signs are slight or no varicosities appear. Early cases are not suitable for it. It is better to wait until venous distension is well established.

6. If the partial arterial occlusion, after one or two weeks, has not been successful, the wound is reopened and the band compressed to complete the occlusion.

7. If complete occlusion of the artery on the affected side is inadequate and if the orbital operation has failed, then the opposite internal carotid artery should be treated like the first. It is first compressed and later partly occluded by the Matas-Allen band with the reservation that complete occlusion may be needed later. The vein this time is not ligated.

In young subjects without arteriosclerosis, in whom the collateral circula-

tion presumably is good, one may be tempted to proceed with immediate complete occlusion and thereby probably save the patient the two-stage operation.

If this be done, the Matas-Allen band takes first place among the materials available, on account of the facility of its release with renewed arterial function, if released within seventy-two hours of its application.

To the surgeon, who has become practised and confident in its use, the Neff clamp stands first. A valuable step in advance would be made, however, if some simpler device were evolved to accomplish this most desirable end of gradual complete occlusion by one operation.

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RESULTS OF TREATMENT BY AUTOGENOUS GLAND FILTRATE IN HODGKIN'S DISEASE

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Up to the present time, no conclusive evidence has been brought forward which would definitely indicate the nature of Hodgkin's disease. MacCallum [1] states: "The disease has some of the characters of a tumor growth, but by far the greater weight of evidence is in favor of its being an infectious process involving simultaneously much of the lymphatic system." Possibly much of the uncertainty which is still attached to this condition may be attributed to its laborious and slow crystallization as an entity, distinct from true leukæmia, pseudoleukæmia and lymph gland neoplasms. The sharp differentiation on a histo-pathologic basis is to be credited to Sternberg,[2] Reed [3] and Longcope.[4] In discussing the evidence which might have a bearing on the unsettled question of etiology, Clark [5] pointed out that Hodgkin's disease resembles an infectious process in the following ways: 1, there is an acute and a chronic form of the disease and the acute cases may run a peculiarly rapid and malignant course; 2, the disease may remain as a local affection for years and then become generalized and rapidly fatal; 3, the lymph glands most frequently affected are those which are most easily infected through the skin and mucous membranes; 4, it is specific for one particular tissue, namely, the lymphadenoid tissue; 5, its mode of spread is usually from the affected gland to the nearest; 6, it is often accompanied by a recurrent type of fever; 7, in the final stages there is cachexia and often diarrhœa, hæmorrhages from mucous membranes and pyrexia, as in the final stages of a septicæmia; 8, finally the disease has the histologic appearance of an infectious process. To these points may also be added as further suggestive evidence, the fact that the blood picture is usually more characteristic of an infectious process than of a neoplasm. That this is an infectious disease, as was pointed out by Ebstein,[6] has been generally although not universally accepted. Gibbons [7] contends that all of the points enumerated by Clark are not universally true of all cases, or might as easily be applied to certain types of tumors. Among those who believe that Hodgkin's disease is neoplastic in character are Coley, Oliver, Tsunoda, Mallory and Warthin.[8] Lubarsch and Levin believed it to be a border-line condition between inflammatory processes and malignant tumors, not degenerative but proliferative and therefore biologically identical with carcinoma cells.[8] Barron [9] believes that the inexorable progressive course toward a fatal termination is the only factor in which it is at variance with an infectious disease and harmonizes with malignant tumors. Symmers [10] has suggested another conception of Hodgkin's disease. He does not believe that this condition provides any criteria by which it may be grouped either among the inflam-

matory diseases or among the neoplasms. Its histogenesis, he suggests, is determined by 1, preliminary hyperplasia of the lymphoid cells in various parts of the body; and 2, by the discharge of mononuclear and multinuclear giant cells from the bone marrow with or without eosinophiles and eosinophilic myelocytes and their arrest by the hyperplastic lymphoid depots in pursuit of their function as filters, the fibroblastic reaction in the recipient tissues representing a mechanical process designed to support the excess of cells by which they are burdened.

Were the belief that Hodgkin's disease is of infectious origin supported by the constant and controlled finding of an organism which fulfilled Koch's postulates, the problem would be clearer. But this is not the case. Sternberg's[2] opinion that it is closely related to tuberculosis has not been universally accepted, although the recent publications of L'Esperance [11] stimulate interest in a possible relation to avian tuberculosis. This interest is heightened by Lay Martin's results with the use of avian tuberculin, as yet not published.[12] Dorothy Reed [3] had used tuberculin, with negative results in five cases.

Considerable interest was aroused by the publications of Fraenkel and Much,[13] Bunting and Yates,[14, 15] and Billings and Rosenow [16] dealing with a diphtheroid bacillus, the so-called *B. Hodgkini*. This organism they had recovered in many instances from the lymph glands in Hodgkin's disease. Furthermore its introduction into laboratory animals was sometimes followed by a generalized lymphadenoid involvement, not, however, typical of Hodgkin's disease. Autogenous vaccines, prepared from this organism, were used by these investigators and by others, including Fox,[17] Mellon,[18] and Bloomfield.[19] Its use, both with and without attendant röntgenotherapy was not successful in permanently curing the disease. Bloomfield found no special relation between this diphtheroid bacillus and Hodgkin's disease and isolated identical organisms from the lymph nodes from a great variety of sources both normal and pathologic. Negative results followed the attempts of Longcope,[20] Cunningham and McAlpin,[21] and Stewart and Dobson [22] to transmit Hodgkin's disease experimentally to anthropoid apes and other monkeys.

Coley,[23] who believes that Hodgkin's disease and lymphosarcoma are closely allied etiologically, states: "The tumors are as a rule extremely radiosensitive and are likewise responsive in a remarkable way to treatment with the mixed toxins of erysipelas and *bacillus prodigiosus*. Cases of lymphosarcoma so treated should show a cure or at least a complete control of the disease for a long period (five years or more) in a very considerable number of cases, *i.e.*, 10 to 15 per cent. Typical cases of Hodgkin's disease still show a very bad prognosis, and permanent control can be expected in only a very small number of cases."

In September, 1928, Wallhauser and Whitehead [24] published a preliminary report of their results with a new immunological method of treating

Hodgkin's disease. They made no assumptions regarding the specific nature of Hodgkin's disease, but confined themselves to the statement:

> The use of autogenous extracts as carried out in our cases is based upon the premise that the disease is of toxic origin, and that the organisms described by Bunting and Yates, Billings and Rosenow and others, contribute secondarily to the disease picture. It is not our purpose to contend that the reactions observed in this series are of a specific nature. It is our belief that the specific lesions of Hodgkin's disease contain certain amounts of a toxin which when injected in small doses into unaffected tissues, stimulates the production of anti-bodies; and that it is the resulting removal of the etiological factor which arrests the pathological process and permits a return to normal. We are not prepared to make an issue of this point however, and wish to rest with a description of the procedure and the results obtained.

They summarize their method as follows:

> The procedure consists essentially in the use of autogenous, bacteria-free extracts made from the specific lesions of the disease. This extract was given in small and usually increasing doses, subcutaneously. The treatment period extended over several months in each case. No other treatment was given excepting general hygienic direction, as noted in the case histories.

The summary of this preliminary report included the following:

> The first effect noted was softening and regression of the enlarged nodes. This progressed steadily, leaving only fibrous nodules, which were hardly palpable and which also disappeared after several months. The cachexia was gradually but definitely reduced, finally disappearing entirely. Symptoms such as nausea, vomiting, urinary retention, anorexia and asthenia were relieved. The temperature reached the normal more slowly. Gain in weight was striking in two cases.

On May 21, 1929, Doctor Wallhauser was so kind as to inform me of the subsequent course of his original three and subsequent cases. At that date, of eleven treated cases, five he found improved, five had died (all causes) and in one the treatment had been discontinued.

It is for the purpose of adding further information to the subject that I am at this time publishing the results in nine cases treated by this method, although only one year has elapsed since beginning treatment. This short time, of course, allows one to entertain little more than an impression.

In all cases, the lymph glands which were used for the filtrate were removed under local anæsthesia. In none did any infection develop nor did the glands or filtrate yield any growth on culture. The filtrate used was prepared for me by Miss Mary Poston, through the courtesy of Doctor Harold Amoss, the Director of the Biological Division of the Medical Clinic of the Johns Hopkins Hospital.

The technic of preparation of the filtrate differed in some respects from that described by Wallhauser and Whitehead. The glands were cleaned of fat and washed of blood aseptically, in a "bacteria-free" room, with sterile normal salt solution. They were then placed in a "tissue press" [25] and the fluid of the glands collected. This was then filtered (Seitz) and the filtrate diluted with normal salt solution in amounts so that 1 gram of gland substance was represented in 5 cubic centimetres of filtrate plus normal salt

solution. This was incubated and cultured and if sterile was preserved by the addition of either 1 part sterile neutral glycerine to 2 parts filtrate, or 0.35 per cent. tricresol. The tricresol was found more satisfactory. This was then kept in rubber-stoppered bottles, and removed as used by means of a hypodermic needle. The filtrate was then administered subcutaneously, three times a week, beginning with 0.1 cubic centimetre and increasing 0.1 cubic centimetre per dose up to 0.5 cubic centimetre, or in some to 0.7 cubic centimetre per dose. The treatment was in general carried on as described by Wallhauser and Whitehead, that is, continued for six weeks, and following a two weeks' rest period was resumed for another six weeks. After a second rest period the treatments were given once a week until stopped.

REPORT OF CASES

Case I.—L. C. M., white, age thirty-five years, was referred by Dr. T. B. Gunter, of West Palm Beach, Florida, to Dr. L. F. Barker, July 27, 1928. Axillary glands had been enlarged for about one and one-half years. There had also been loss of appetite and weakness. Itching of the skin and some shortness of breath had been noticed only recently. He has lost fourteen pounds in past few years. On physical examination the lymph glands are generally enlarged and of variable size, ranging from four to five centimetres down. The spleen is definitely felt four centimetres below the costal margin on deep inspiration. There is evidence of considerable scratching of the skin. Röntgenoscopic examination of the chest showed a definite increase in the width of the ascending aorta which encroached somewhat on the retrocardiac space as seen in the oblique view. The teleröntgenogram measurements were mediastinal right, 4.2 centimetres and mediastinal left, 8.7 centimetres. The blood examination showed red blood cells, 4,272,000; hæmoglobin, 60 per cent.; white blood cells, 10,400; polymorphonuclear neutriphiles, 85.6; polymorphonuclear eosinophiles, 1:6; polymorphonuclear basophiles, 0; small mononuclears, 6 per cent., and large mononuclears and transitionals, 6.8 per cent. The gastric analysis, stool and urine examination were negative. While under observation there was fever of 100 to 101 degrees each day. The microscopic examination of an excised lymph gland showed the changes typical of Hodgkin's disease, as described by Reed and Longcope. Culture of the gland was sterile.

Prior to the filtrate treatment this patient was transfused twice and had been irradiated (radium) by Dr. C. F. Burnam. There had been little change in his condition other than a drop in the white blood cells count to about 4,000. There had also developed a nearly complete ptosis of the right upper eyelid and a right-sided vocal cord paralysis. This was believed due to radium. At the time the filtrate was started there was daily fever of 101 degrees. October 26, 1928, the first dose of filtrate was given and increased every other day, as outlined above, up to 0.5 cubic centimetre. November 12 the temperature had come down to normal and remained normal during the rest of the time this patient remained in the nursing home. November 17 the ptosis had entirely cleared, although the vocal cord paralysis remained and did not change while under observation. The glands became definitely small, according to three observers, although not particularly softer. The spleen was not palpable at the time the treatment was started. No further radium was used after filtrate was started. October 30, 1928, the red blood corpuscles numbered 3,856,000, hæmoglobin, 63-65 per cent., and white blood corpuscles 5,600. The patient claimed to feel better and stronger, although there was no increase in weight. November 26 after one month of treatment the red blood corpuscles were 3,744,000, hæmoglobin, 60 per cent., and white blood corpuscles 6,300. The patient then returned to his home in Florida, and was to continue the treatment as outlined above. About December 1 the fever returned, 99.2 to 102 degrees, and patient went back to bed. Early in January his condition was much

improved, the fever had subsided and glands were smaller and softer. He had gained in weight. January 16, red blood corpuscles 4,310,000 hæmoglobin 66 per cent.; white blood corpuscles 7,850. The filtrate had been given from October 26 until December 15 and was stopped until about January 1. Coincident with resuming treatment this patient became progressively worse and died March 27, 1929.

CASE II.—P. B. S., a white man, age forty-eight years, consulted Dr. S. R. Miller, of Baltimore, November 25, 1928, because of failing endurance. The history of this patient is interesting because this was his only complaint, for which he had had several teeth extracted during the previous summer. He had felt overworked, had lost ten or twelve pounds in weight, had been sleeping poorly and was annoyed by a slight cough. On physical examination no general glandular enlargement was found; although there were two enlarged lymph glands below the outer border of the lower end of the left sterno-mastoid muscle, and the right inguinal glands and left axillary glands were enlarged. There was modified impairment of the percussion note on both sides close to the sternum at the level of the second costosternal junction. In the back the percussion note was impaired in the interscapular region from the third to the seventh vertebral spines, somewhat more marked on the right than on the left side. There was irregular fever of 100 to 101 degrees. Stereoröntgenoscopic examination of the chest showed an increased mediastinal shadow.

November 28, 1929, one of the lymph glands in the left lower cervical region was removed and was believed by Dr. W. G. MacCallum to show the changes characteristic of Hodgkin's disease.

Between November 27 and December 12, 1928, the red blood corpuscles count averaged 3,800,000 and the white blood corpuscles count 13,000. Filtrate treatment was started December 12, and at the same time the patient was kept in bed with forced nourishment, administration of liver extract and Blaud's pills. After ten days the red blood cells count had increased to 4,500,000, the white blood corpuscles count to 18,000. The filtrate dosage was kept at 0.5 cubic centimetre December 23, immediately after returning home from the hospital, the patient had severe attacks of abdominal pains accompanied by diarrhœa and occasional nausea. The filtrate was discontinued and resumed after return to hospital early in January, 1929. There was no perceptible progress. In spite of forced feeding it was impossible to increase the patient's weight. Liver extract and Blaud's pills were not tolerated well and the filtrate was the only treatment given during January and February, when it too was discontinued by the patient. He felt well in March, then had a relapse in April, was able to follow a golf match in May but has since retrogressed steadily. No treatment is being given, partly owing to an unwillingness on his part to acknowledge the seriousness of his condition.

CASE III.—C. R., white, age thirty-six years, had been treated by Dr. C. F. Burnam since March, 1926, with radium and deep X-ray. The diagnosis of Hodgkin's disease had been made in February of that year by Doctor Mills of Colorado Springs. His enlarged glands were confined almost entirely to the cervical and axillary regions and had been very amenable to irradiation until January, 1929, when, following influenza and broncho-pneumonia, there was recurrence of the glandular enlargement, lassitude and persistent cough. March 6, 1929, there remained a large, hard mass of fused glands above and behind the right clavicle. The skin over the right cervical and axillary glands was tanned a deep mahogany brown. March 7, 1929, a röntgenoscopic examination of the chest showed the heart and aorta within normal limits and a small area of unresolved pneumonia (rather than pleurisy) at the right base. (Dr. F. H. Baetjer.) The blood examination showed: red blood corpuscles, 3,870,000; hæmoglobin, 66 per cent.; white blood cells, 8,800; polymorphonuclear neutriphiles, 81 per cent.; polymorphonuclear eosinophiles, 1 per cent.; small lymphocytes, 14 per cent.; large mononuclears and transitionals, 4 per cent.

The temperature rose to about 100 degrees every day. March 8, 1929, the glands of the left axilla were removed for preparation of the filtrate. March 10, 1929, a skin

sensitization test was done with the filtrate of another individual with Hodgkin's disease. A small wheal and some increase in fever resulted. March 11, 1929, treatment with the patient's own filtrate was started and by March 22, the patient was getting 0.6 cubic centimetre every other day. March 22 he was discharged from the hospital and the glands of the right side of the neck were noted as being much smaller. From March 22 until May 1, 0.5 cubic centimetre of the filtrate was given every other day. At about this time the patient began to notice each morning a definite swelling of his face and neck. His cough had become increasingly annoying. On May 15 was found a flat, rounded swelling about 10 centimetres in diameter, fluctuant, over the lower right chest—covering the area of the 10th, 11th and 12th ribs. The percussion note over the whole right chest was flat. Thick creamy pus, sterile on culture, was aspirated from the fluctuant area, and 2500 cubic centimetres of clear amber fluid were removed from the right chest. A röntgenogram after thoracentesis showed erosions of the 11th and 12th ribs. A week later thoracentesis was repeated, 2000 cubic centimetres being removed. Although the supraclavicular glands had diminished in size during the period in which the filtrate had been used, the development of pleural exudate, bone erosions and the sterile abscess in the back prompted us to return to the use of the agent which had kept this patient in good condition for three years, namely, irradiation.

From this period on, this case loses interest as far as the use of the filtrate is concerned. We have at intervals given him further irradiation; there have been several additional thoracenteses, at monthly intervals, and we continued the administration of 0.6 cubic centimetre of filtrate once weekly, until September 15, 1929. The patient is a farmer and works eight hours daily.

Case IV.—M. R., a colored woman of twenty-eight years, had noticed her enlarged glands in December, 1928. When seen in the University Hospital on March 7, 1929, she complained of weakness, restlessness and shortness of breath. She had lost twenty-five pounds during the preceding year, was obviously anæmic, and the general glandular enlargement was striking. Some of the glands were the size of a lemon. The skin showed evidences of scratching, with irregular leukoderma and melanoderma. The mediastinal dulness was slightly increased on both sides. The spleen was enlarged about 5 centimetres below the costal margin, and on deep palpation there was a suggestion of retroperitoneal glands. There was slight œdema of the feet and ankles. Röntgenogram of the chest on December 7, 1928, showed broadening of the upper mediastinal shadow, with sharply outlined borders. There was moderate increase in root shadows with enlargement of the glands of the left hilus. The temperature was the typical Pel-Ebstein type, reaching about 102 degrees. There was no free gastric hydrochloric acid. There was sugar in the urine. The red blood cells count was 1,110,000; hæmoglobin, 35-40 per cent.; white blood cell counts 30-32,000; polymorphonuclears, 90 per cent.; eosinophiles, 0; transitionals, 8 per cent., and myelocytes, 1 per cent.

The microscopic examination of an enlarged gland showed the typical changes of Hodgkin's disease, rather far advanced.

The filtrate treatment was started March 9, 1929, and by March 17, the patient was receiving 0.5 cubic centimetre every other day. On the 17th, during which time the patient had been in bed, definite diminution in the size of the glands was noted. The spleen was smaller by measurement. This was again noted March 25. The glands were also softer. The only other treatments used were Blaud's pills, 60 grains per day, and dilute HCl. By April 15, the feeling of improvement was less. The fever was reaching 104 degrees, although the glands and spleen were definitely smaller and softer. During the period of administration (while remaining in bed in the hospital) the blood picture had improved. March 25, the red blood cells were 2,150,000; the hæmoglobin, 45 per cent.; white blood cells, 3,200. April 1 the patient insisted on discharge from the hospital and returned three times a week for 0.5 cubic centimetre of filtrate. She died suddenly at home April 13.

Case V.—E. E. L., a white man, age thirty-six years, was referred to Dr. L. F.

Barker by Dr. Harold Disbrow, of Lakewood, N. J., February 8, 1929. He had had meningitis when a child, which had affected his hearing. During the two years before consultation he had become nervous and tired easily. Enlarged glands in the right axilla and groin had appeared during the past year and on consulting Doctor Disbrow in January, 1929, the general glandular enlargement was found. A gland was removed at this time and examined by Doctor Mallory, of Boston, who did not feel that an accurate diagnosis could be made. Skin itching had not been noted. There had been one febrile attack (possibly influenza) recently, but otherwise the temperature was said to be normal. It might be noted that this patient has a farm and is in close contact with poultry.

Other than a general glandular enlargement and palpable spleen, the physical examination was essentially negative. Some of the lymph glands were as large as walnuts.

In a röntgenoscopic examination of the chest, the lungs appeared slightly hazy, particularly on the right where there was increased fibrosis about the hilus.

A lymph gland was examined microscopically and its appearance did not permit a definite diagnosis. There was slight peripheral scarring and the germinal centres were fairly well preserved. The tissue was predominantly lymphoid, with only a slight reticulo-endothelial increase, and only small numbers of eosinophiles. There were no definite Dorothy Reed cells, no giant cells nor any other evidence of a specific disease. Several members of the Department of Pathology in the Johns Hopkins Hospital thought that the gland represented early Hodgkin's disease. This section was commented on by Dr. J. B. Ewing, of New York, as follows: "Chronic granuloma of lymph node. Hodgkin's diagnosis based on clinical and pathological picture, although the latter is not absolutely definite."

The blood Wasserman was negative. The blood count on February 8, 1929, showed red blood cells, 4,914,000; hæmoglobin, 85 per cent; white blood cells, 7,300, of which the polymorphonuclears were 54.4 per cent.; eosinophiles, 5.2 per cent.; basophiles 1.2 per cent.; small mononuclears, 34 per cent., and large mononuclears, 5.2 per cent. The urine and stool examinations were negative.

The filtrate was administered by Doctor Disbrow, and on October 11, 1929, Dr. L. F. Craver, of the Memorial Hospital in New York, reported to me as follows: "In regard to the result in his case from the use of your filtrate, the patient stated to us that after a month's treatment he became run down, developed bronchitis and was in bed for two weeks, but that subsequently following a rest in the country, he showed marked improvement and gained eight pounds." In March 1930, Doctor Disbrow reported to me that the patient had died.

Case VI.—L. H., a white boy, age nine years, in August, 1928, noticed enlarged cervical glands and had a daily fever of about 101 degrees. The blood count at the time was red blood cells, 4,280,000; hæmoglobin, 72 per cent. Differential: polymorphonuclears, 87 per cent.; small mononuclears, 9 per cent., and large mononuclears and transitionals, 4 per cent. Röntgenoscopic examination of the chest showed that the mediastinal glands were markedly enlarged with some root infiltration on the left side. A cervical lymph gland was excised and showed the typical changes of Hodgkin's disease. Treatment by irradiation was carried out through the succeeding months by Dr. C. F. Burnam. He did well and the blood examination during that time showed the following: Red blood cells, 4,000,000; hæmoglobin, 73 per cent.; white cells, 7,500; polymorphonuclears, 75 per cent.; eosinophiles, 3 per cent.; small mononuclears, 18 per cent.

Röntgenoscopic.—There was marked improvement in the appearance of the chest. There was still evidence of a mediastinal mass but it was disappearing on the left side where it was most marked. The weight was 83¼ pounds September 27, 1928. October 20, 1928, it was 93½ pounds.

November 19, 1928, the cervical glands were practically normal on palpation. There was slight impairment of the percussion note on the left side at the level of

Ludwig's angle about 6 centimetres from the mid-sternal line and about 2½ centimetres on the right. The spleen could not be felt. The weight was 103½ pounds. Röntgenoscopic examination of the chest on this date showed a definite improvement, in that the shadow noted prior to this did not extend so far up as it had in earlier examinations. The straight line which was seen in previous plates seemed to be irregular and the density of this shadow was not so marked.

January 26, 1929: Red blood cells, 4,500,000; hæmoglobin, 84 per cent.; white blood cells, 6,400; polymorphonuclears, 73 per cent.; polymorphoesinophiles, 0; small mononuclears, 22 per cent.; large mononuclears, 5 per cent. February 21, 1929: *Röntgenoscopic.*—The shadow is less dense than in the previous plates and does not extend as far into the neck.

About this time, the patient had a severe cold which was slow in subsiding. He developed a persistent cough and for the first time began to lose weight. The cervical glands began to enlarge. March 25, 1929: The mass seemed the same size if not a little larger and seemed to extend farther on the left side. It was somewhat denser. The trachea showed evidence of compression just above the level of the first rib and extending through the second and third ribs.

So much irradiation had been used that it was thought advisable to avoid further treatments if it were possible, and on March 28, 1929, Doctors Hamburger and Burnam referred this patient to me for filtrate treatment.

April 1, 1929: A few hours following the second injection, 0.2 cubic centimetre, the boy had an attack of rather acute respiratory difficulty. He could breathe with relatively less difficulty only in a sitting position, and had a troublesome cough. Treatment was discontinued. The mediastinal dulness measured 11 centimetres in the second interspace. The respiratory difficulty gradually subsided. April 16, 1929, filtrate treatments were resumed and the dosage was gradually increased to 0.7 cubic centimetre, at which point his fever was increased and respiratory difficulty reappeared. It was decided to discontinue treatments and resume irradiation. The boy gradually became better and began to gain in weight. He did well until June 15, 1929, when he was seized with very acute difficulty in breathing, and died after about three hours.

This case brings out several noteworthy features even though its use in evaluating the filtrate treatment is marred by the coincident use of irradiation. The lymph glands, although previously much irradiated, yielded a filtrate of apparent considerable effect. Unless it may have been coincidence, a dose of 0.2 cubic centimetre brought about a local effect in the tracheal glands which caused difficulty in breathing. When the dose was increased to 0.7 cubic centimetre there was a general as well as a local reaction. It may have been an error to increase the dose to an amount which would produce a general reaction but I believed it advisable to learn whether the filtrate from these previously much irradiated glands had any therapeutic value. On the other hand it may have been that we were dealing with an intractable acute exacerbation of the disease, with marked tracheal involvement and that the course of the disease was actually little affected by the filtrate. Unfortunately a necropsy was not done so that we have no information regarding the peritracheal glands which, in the röntgenogram, almost suggest actual invasion of the trachea. Invasive Hodgkin's glands have been observed not infrequently, sometimes so marked that a sarcomatous transformation has to be considered. These usually have occurred in the mediastinum and have been thought by many to have originated from the thymus. Ewing concluded that the invasive form of mediastinal Hodgkin's disease is in

reality a thymic tumor which should be separated from other forms of the disease, and which owes its malignancy to its origin from peculiar reticulum cells of the thymus. (Simonds.[8])

CASE VII.—R. L., white man, age forty-four years, was referred by Dr. C. H. Berlinghof, of Binghamton, N. Y. He had had enlarged right cervical glands for about one and one-half years. He had been gassed during the war, and had been troubled by a chronic cough since 1918. The sputum was negative for *B. tuberculosis*. During the past year he had lost five to ten pounds in weight and had had nocturia once or twice every night. The epitrochlear, inguinal, and cervical glands were definitely enlarged. The axillary glands were not so pronounced. The spleen was occasionally palpable.

The red blood cells count on December 28, 1928, was 4,120,000; hæmoglobin, 67 per cent. A lymph gland excised January 2, 1929, by Dr. William H. Hobbs, in Binghamton, showed the changes typical of Hodgkin's.

In June the patient was examined in Baltimore. The red blood cells count was 2,700,000; hæmoglobin, 43 per cent., and white blood cells, 2,700. The urine was red and turbid; positive for albumen; the guaiac was positive and the smear showed red blood cells and casts. Röntgenogram of the chest showed enlarged heart and aorta with marked root infiltration. The temperature ranged between 99.5 and 103.5 degrees.

A filtrate was made from glands excised June 15, 1929, and the patient returned to his home. The treatment has been given by Doctor Berlinghof.

August 28, 1928, Doctor Berlinghof reported that following the injections of 0.1 cubic centimetre on June 21, and 0.2 cubic centimetre on June 23, there was no reaction. The night of June 25, following 0.3 cubic centimetre, the temperature rose to 101 degrees accompanied by hot flashes and weakness. The next day the temperature was 102 degrees and remained about there until July 2. Until July 8, there was subnormal temperature. On July 9, 0.1 cubic centimetre was given, followed by a severe reaction with temperature of 101.8 degrees in twelve hours, tingling of extremities, throbbing in head, succeeded by drowsiness and great weakness. The urine has continuously shown blood and this man's condition was so bad that Doctor Berlinghof hesitated to stir him up even by the use of minimal doses of the filtrate. The lymph glands have diminished greatly in size. I suggested that the filtrate be diluted and smaller doses used. This was more satisfactory but more than 0.1 cubic centimetre of the undiluted filtrate could never be given without reactions. Death occurred October 1, 1929.

CASE VIII.—N. S., a white man age, thirty-five years, was referred by Dr. C. A. Meals, of Braddock, Pa., to Dr. T. P. Sprunt and Dr. J. A. C. Colston, of Baltimore, in July, 1929. He had had a left nephrotomy performed in 1914, tonsillectomy in 1919, and appendectomy in 1924. Of recent years he has had recurrent attacks of pain in the left renal region, typical of a renal colic he had had since boyhood. Dating from 1927, there had been a slow progressive enlargement of the cervical, axillary and epitrochlear lymph glands. In September, 1928, lymph glands were removed from the right axilla. During the spring of 1929, he had had a slight chronic cough, accompanied by increasing weakness and daily pyrexia.

On examination, he was moderately undernourished. There were enlarged cervical, axillary and epitrochlear glands. The inguinal glands were palpable. The spleen could be felt. There was deep abdominal tenderness on the left. The retromanubrial dulness was increased, particularly on the left. The temperature was irregular, rising to 101 degrees.

Cervical lymph glands were removed July 15, 1929, for diagnosis and preparation of filtrate. On section they presented the typical picture of Hodgkin's disease. Left nephrectomy was performed by Dr. J. A. C. Colston August 2, 1929. He was discharged from the hospital in good condition August 25, 1929, was sent home and the

filtrate was to be given by Doctor Meals. October 28, 1929, the patient reported that there had been no change in his general condition, that he was having continuous fever up to 101 degrees, and that many new lymph gland enlargements had appeared under the arms and all around the neck.

CASE IX.—H. S., white, age thirty-seven years, was referred by Dr. J. C. Bloodgood June 19, 1929. In a general physical examination in September, 1925, for symtoms referable to a cardiac condition, the peripheral lymph glands were not noticeable. For these symtoms he was in a hospital in September, 1927, where one enlarged left cervical gland was found enlarged and excised for diagnosis. It was thought to represent a chronic inflammatory reaction, or possibly "lymphoma." In January, 1928, the patient was examined in the Johns Hopkins Dispensary. He had several discrete, firm, rubbery, freely movable glands above the left clavicle. The heart condition was thought to be due to mitral and aorta insufficiency, mitral stenosis and myocardial decompensation. In May, 1929, another lymph gland was excised. Hodgin's disease was diagnosed (Doctor Bloodgood) and the patient referred for filtrate treatment. No demonstrable evidence of a mediastinal mass was found in X-ray.

At the time filtrate treatment was started, June 24, 1929, he was well nourished and able to work as a tailor. The lymph gland involvement was limited to the left supraclavicular region, where there was a mass of conglomerate glands elevating the skin, about the size of half an orange. There was one large gland in the left axilla and one beneath the angle of the jaw on the left.

About ten days following the initiation of filtrate treatment, one could be sure that the large mass above the clavicle was smaller and somewhat softer. The individual glands could be felt more distinctly and were a little more movable. Toward the end of July, about the fifth week, this regression had ceased and enlarged glands became palpable about the periphery of the original mass. The patient was having difficulty wearing a collar. At his urgent request, most of the larger mass of glands was excised, which I was very willing to do in order to examine microscopically glands from a patient after six weeks of treatment. This was done and the treatments, resumed August 15th, were continued until January, 1930. By that time it was apparent that the condition was progressing. Radium was used with marked benefit. The patient's general condition improved, and the supraclavicular glands diminished in size. We have continued using the filtrate with the hope that the combined treatments will be more effective than either agent alone.

SUMMARY OF CASES TREATED

CASE I.—In a previously irradiated patient, confined to a nursing home, a remission took place shortly after beginning treatment. This remission continued for two months, but death took place during the fifth month.

CASE II.—This patient presented very severe general effects (lassitude, fever, anæmia, leucocytosis) from a localized cervical and mediastinal glandular involvement. There was no indication that the disease was in any way affected by filtrate treatment extending over ten weeks. Treatment discontinued by the patient and his condition remains grave.

CASE III.—A patient with supraclavicular and axillary involvement controlled for three years by irradiation, who recently had developed bone lesions (ribs) and hydrothorax, was not noticeably affected by eight weeks' filtrate treatment. Treatment continued for four months at weekly intervals, combined with irradiation.

CASE IV.—The condition was very generalized and advanced. Immediately following initial filtrate treatments, the glandular and splenic tumors

became smaller and softer. The anæmia improved slightly but the high fever persisted. Death after four weeks of treatment.

CASE V.—A very early case of Hodgkin's disease was unimproved following four weeks of filtrate treatment. Improvement followed discontinuance of treatment and rest in bed. Weight also improved. Later recourse was had to irradiation, but death occurred in about one year.

CASE VI.—Cervical, peritracheal and mediastinal glands had been extensively irradiated prior to filtrate treatment. This patient was either very sensitive to the filtrate or it was administered just before the exacerbation which ended in death.

CASE VII.—This patient presented fairly advanced Hodgkin's disease complicated by nephritis. He was apparently as sensitive (temperature effects) to the filtrate as the patient of Case VI. Following very few treatments the glands decreased greatly in size, but death occurred four months after start of treatment.

CASE VIII.—Disease of about two years' duration, confined to cervical, axillary and epitrochlear glands, with slight splenic enlargement. Nephrectomy, for pyonephrosis, performed immediately prior to filtrate treatment. Filtrate treatments for six weeks have had no apparent effect on the course of the disease.

CASE IX.—Disease of four years' duration, localized to left cervical and axillary groups of glands. Definite improvement for very short time following initiation of treatment, but condition later was not perceptibly affected. Irradiation was instituted with marked benefit.

CONCLUSIONS

Nine patients who had Hodgkin's disease were treated by the immunological method suggested by Wallhauser and Whitehead. This treatment consists in the frequent administration of small doses of a diluted filtrate, the extract of affected lymph nodes.

Five died of the disease, three of whom had transitory remissions. One seemed unaffected by the treatment and returned to irradiation. One seemed very slightly improved for a time but retrogressed and was irradiated. One was apparently unaffected after ten weeks and another after six weeks.

These results are not clear enough to indicate whether or not the filtrate treatment has an appreciable effect on the usual course of Hodgkin's disease. Four cases suggest that it may be instrumental in bringing on a remission. Should the experience of others confirm this, it is to be hoped that this treatment will be given an extensive trial, preferably with no other treatment, but if conditions demand, combined with irradiation.

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HARE-LIP AND CLEFT PALATE*

AN ANALYSIS OF 184 CASES

By Carl Goodwin Burdick, M.D.
of New York, N. Y.

During the past ten years we have seen 184 congenital malformations of the lip and palate at Bellevue Hospital; 173 of these were in children and eleven in adults.

The various types of malformation were as follows:

Unilateral incomplete uncomplicated hare-lip	18
Unilateral incomplete hare-lip; cleft alveolus	3
Unilateral incomplete hare-lip; incomplete cleft palate	7
Unilateral incomplete hare-lip; complete cleft palate	4
Unilateral complete uncomplicated hare-lip	3
Unilateral complete hare-lip; cleft alveolus	4
Unilateral complete hare-lip; incomplete cleft palate	6
Unilateral complete hare-lip; complete cleft palate	44
Incomplete cleft palate uncomplicated	35
Complete cleft palate uncomplicated	2
Bilateral incomplete uncomplicated hare-lip	1
Bilateral incomplete hare-lip; incomplete cleft palate	1
Bilateral incomplete hare-lip; complete cleft palate	1
Bilateral complete uncomplicated hare-lip	2
Bilateral complete hare-lip; cleft alveolus	2
Bilateral complete hare-lip; complete cleft palate	26
Miscellaneous: Hare-lip—no description given	3
Cleft palate—no description given	3
Hare-lip and cleft palate	5
Bilateral hare-lip and cleft palate	1
Hare-lip previously repaired	2
Bilateral hare-lip, previously repaired	1
Repaired hare-lip with cleft palate	9
Cleft palate, previously repaired	1
	184

Forty-five of these patients were never operated upon, twenty-two dying and the majority of the others never being in a satisfactory physical condition to attempt surgical interference. In a few the cleft in the palate was so wide that operation was deferred and they failed to return.

Age of operation.—The lip and alveolus should be repaired as soon after birth as the infant's physical condition will permit, which is usually at the end of ten days or two weeks, if the birth weight has been regained and feed-

* Read before the New York Surgical Society, March 26, 1930.

ing is satisfactory. At this early age the bones are more pliable, moulding of the alveolus is easy, the patient will be able to nurse normally and the horrible deformity which the parents abhor will be corrected. The cleft in the palate, if present, is usually too wide to attempt closure at this time, but correcting the deformity of the lip and the alveolus facilitates the normal growth of the bony palate and the width of the cleft diminishes as the infant develops. We formerly felt that the palate should be repaired as soon as the cleft was narrow enough to insure a moderate degree of success, which was usually between the first and the second year. After analyzing this group of cases and realizing the high mortality and comparatively poor results in many of these patients with cleft palates, we are strongly inclined to agree with

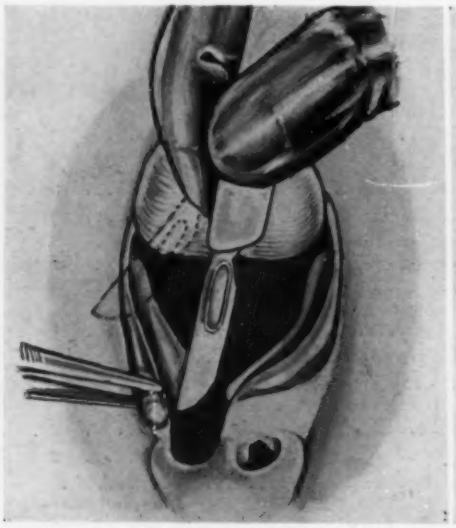

FIG. 1.—Incising the mucous membrane at its reflection on to the cheek and dividing the attachment of the ala nasi.

FIG. 2.—Freeing the soft tissues of the cheek by blunt dissection with further division of the ala nasi if necessary.

some of the earlier writers on this subject and postpone the operation on the palate until the child is at least three years old and preferably older.

While many advocate the repair of the palate before the child begins to talk in order that speech may not be affected, our feeling is that no matter how successful the operation is, speech will be far from normal and all these patients must be labored with by teachers and parents irrespective of what age the closure may have been obtained.

Operation.—In the operation on the lip or palate the patient should be in the Rose position and secured to the table, the surgeon sitting at the head and an assistant standing on either side facing the operator. The first sponges and assists in passing and tying the sutures, the second keeps the nasopharynx free of blood and mucus with the aspirator and depresses the tongue when necessary. Ether vapor is administered through a nasal tube or a crooked metal tube placed in the angle of the mouth, similar to that used in tonsillectomy. A preliminary suture is always passed through the tongue and is

not removed until the child is well out of the anæsthetic. We prefer the use of the Whitehead mouth gag in all palate cases.

HARE-LIP

Incomplete Hare-lip.—In which the tissue of the lip and nostril above the actual fissure are normal. In this type of case the simple operation of Nelaton or Graefe gives excellent results. A more common variety is that in which the tissues above the fissure are abnormal. The skin margins have coalesced but the deeper muscular portions have failed to unite and the nostril is wider than it should be. To obtain a satisfactory result in this type of deformity all the thinned tissue must be removed and the incomplete cleft converted

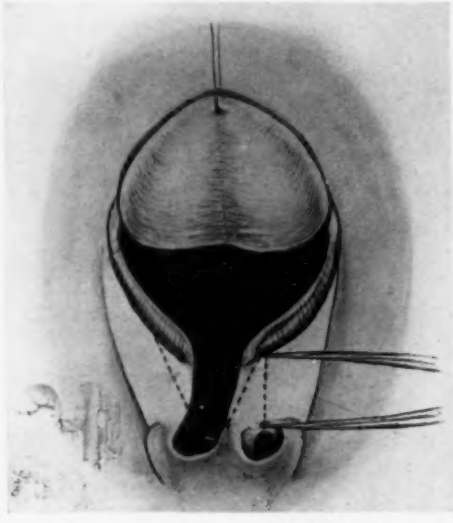

FIG. 3.—Estimating the width of the normal lip with dividers and outlining proposed incisions on the cleft side.

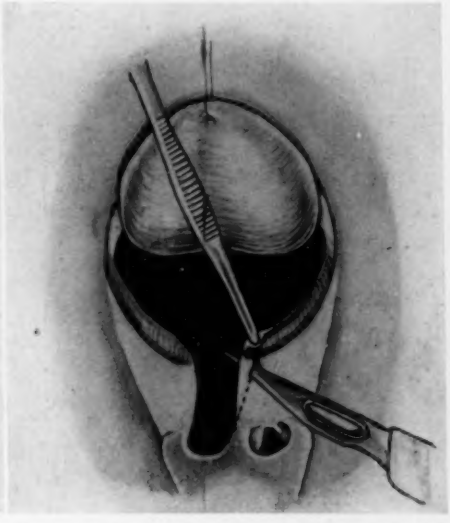

FIG. 4.—Transfixing of flap from below upwards.

into a complete one. Therefore the same operative procedures are applicable as in the complete cleft.

Complete Hare-lip.—A—With a normal alveolar arch. 1. To approximate the edges of the cleft without tension and to correct the flattening of the nostril it is essential to free the lip and ala nasi from their attachment to the maxilla. An incision is made through the mucous membrane at the site of its reflection on to the cheek, the attachment of the ala nasi is divided and by blunt dissection the soft tissues are freed nearly to the orbit. Bleeding is controlled by immediately packing the cavity with gauze which is removed before the sutures are inserted. (Figs. 1 and 2.)

2. The width of the normal lip is measured with dividers and the instrument transferred to the affected side. To estimate the width of the lip on the inner side of the cleft, one point of the dividers is placed at the inner margin of the nostril at a point where the new floor is to join the columella, the other at the vermilion border. On the outer side enough tissue must be saved from

the margin of the cleft to form the floor of the nostril. This means that the upper point of the proposed incision will lie considerably inferior to the corresponding point on the inner side. Due to the widening and flattening out of the vermilion border as the lip approaches the cleft, care must be taken to place the incisions far enough laterally to insure an adequate repair. (Fig. 3.)

3. The flaps are now transfixed with a sharp, pointed bistoury from below upward beginning at the vermilion border. The tabs of tissue still attached at the vermilion border are grasped at their tips with forceps and by making sufficient traction the hæmorrhage is easily controlled until the bleeding points have been seized. The edges of the cleft are now approximated, one or two interrupted sutures being inserted well within the nostril to bring the

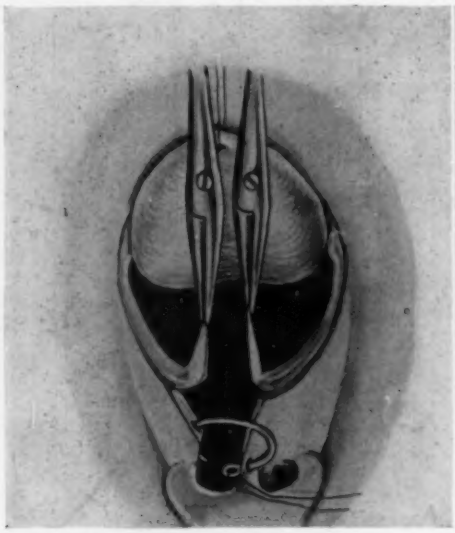

FIG. 5.—Flaps still attached at vermilion border grasped with forceps and first suture inserted within nostril bringing tissue from outer side of cleft around to form the floor of the nostril. (The needle should have been drawn coming out within the nostril.)

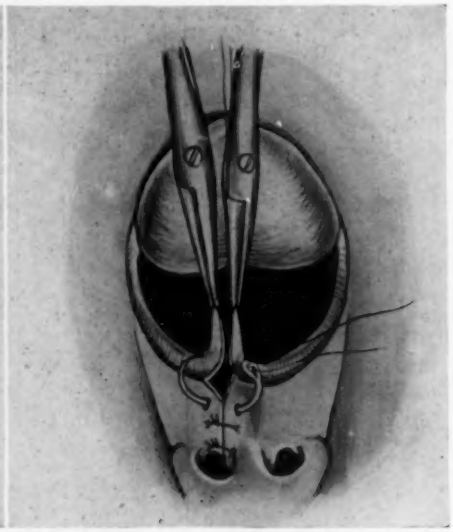

FIG. 6.—Suturing of cleft.

tissue from the outer side of the cleft, which has not been pared, around to form the floor. The remainder of the cleft is now sutured with interrupted horse-hair or "dermal," each stitch passing through the entire thickness of the lip. If the margins of the cleft are thinner than normal they can be widened by making a vertical incision about one-eighth of an inch deep at the right angles to their cut surfaces. As the vermilion border is approached care must be taken to identify it, to thereby insure an accurate approximation. This is facilitated by sponging the tissues with peroxide of hydrogen to remove the blood and rapidly wiping it off with salt solution. The tabs of tissue from the margin of the cleft are now divided downward at an obtuse angle from the vermilion border leaving sufficient tissue to produce a slight pouting, thus allowing for subsequent contraction. (Figs. 4, 5, 6, 7 and 8.)

If the tissues of the outer margin of the cleft are thicker than those on the inner side a more satisfactory approximation may be obtained by dividing the inner margin of the cleft at an angle rather than approximating the edges vertically. There should be no tension of the suture line if the soft parts have been adequately separated from their attachment to the superior maxilla. However, if a flattening of the nostril persists, a double suture of silkworm gut may be passed through the floor of the nostrils, thus obtaining moderate pressure on each ala through the use of a small shirt button or piece of gauze. As our experience has broadened in this type of case we have been able to reconstruct more satisfactory nostrils and there has been less necessity for this retaining suture.

B—With cleft of the alveolar arch. The majority of complete hare-lips

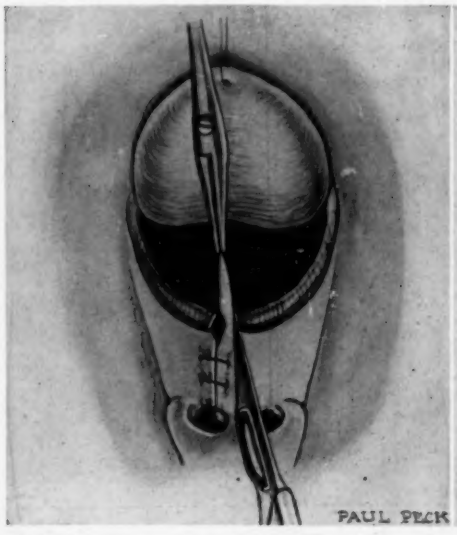

FIG. 7.—Tabs from margin of cleft divided at an obtuse angle leaving enough tissue to produce a slight pouting.

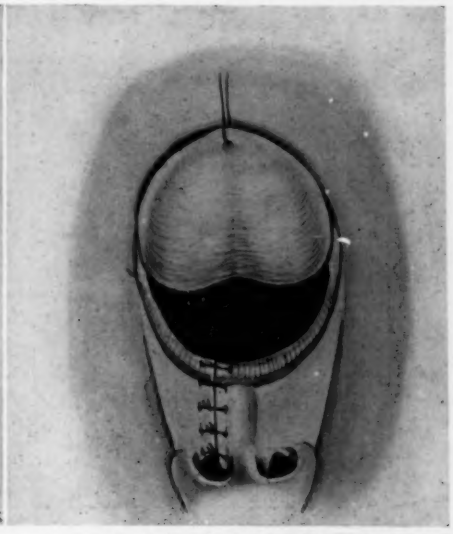

FIG. 8.—Operation completed.

are accompanied by a complete cleft of the palate; therefore the normal curve of the alveolar process must be restored before attempting the repair of the lip. Thompson has pointed out the practicability of moulding the alveolar arch at an early age, two to four weeks, and Vaughan has advocated retaining it in place by means of silver wire. We have adopted these methods as a routine. After anæsthetizing the infant, gradual pressure is made on the unaffected side of the alveolus and it is surprising how easily it can be moulded around until the edges of the cleft in the alveolar process are approximated and the normal curve restored. This procedure also corrects the deviation of the columella which has been previously directed toward the normal side. The edges of the alveolus are now denuded and silver wire of 18 or 20 gauge is passed through the alveolar process well above the tooth follicles, about one-half inch either side of the cleft. An assistant presses the edges of the cleft together and the wire is twisted tightly enough to keep

the surfaces approximated. In older children it may be necessary to divide the alveolar process with a thin-bladed osteotome. The lip is repaired at the same time and it is surprising how easily the margins are brought together without tension, after the normal curve of the alveolar arch has been restored. If the moulding of the arch has not entirely corrected the deviation of the columella, its attachment to the bone must be divided so that with the reconstruction of the nostril it may assume its normal direction. (Figs. 9 and 10.)

Double Hare-lip.—Complicated by the presence of the pre-maxillary bone. In this type of case, the pre- or inter-maxillary bone protrudes like a snout and must be returned to its normal position before attempting closure of the lip. A quadrilateral piece is removed subperiosteally from the vomer to allow reposition of the inter-maxillary bone into the cleft of the alveolar process,

FIG. 9.—Moulding of alveolar process.

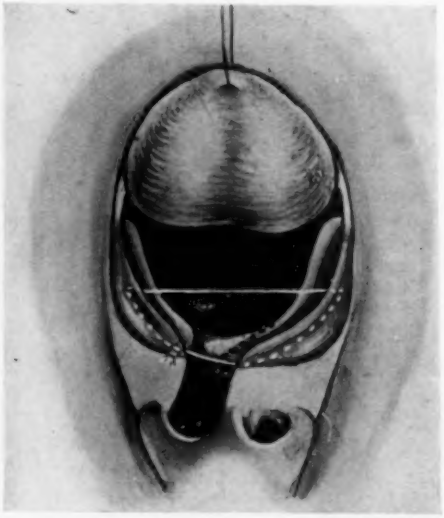

FIG. 10.—Silver wire passed through alveolar process and edges of cleft approximated. (The artist failed to indicate by dotted lines where the alveolus was transfixed.)

the pre-maxilla being pushed back into place and held with a silver wire. The latter is passed in a similar manner as in the cure of a single cleft. In the resection a quadrilateral-shaped piece is preferable to a triangular as the latter would cause the future incisor teeth to tilt backward rather than directly downward. The prolabium is pared quadrilaterally if there is sufficient tissue after transfixing and denuding the clefts on the labial sides to bring the flaps of skin and mucous membrane together beneath it. If this is not possible a triangular section is made and the edges of the lip approximated in a vertical line beneath the apex of the triangle. (Figs. 11, 12, 13 and 14.)

Some authorities advise interposing the prolabium between the denuded edges of the lip so that the vermilion border of the prolabium is continuous with the vermilion border of the sides of the lip, on the theory that the prolabium will develop as the infant grows and thus correct any irregularity which may exist following the original operation. We have not been able to

prove that this plan is feasible and any traction on the prolabium will of necessity increase the flattening of the nostrils which is already aggravated by forcing the pre-maxilla back into the cleft in the alveolus.

We have had a few cases of our own and have seen some which have been operated upon by other surgeons in which the upper lip was much flattened and contracted. These usually followed double clefts of the alveolus, espe-

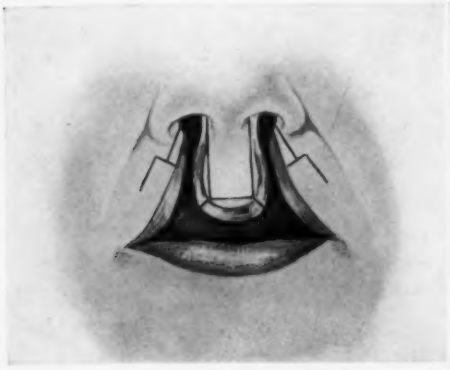

FIG. 11.—Schematic outline of incisions for double hare-lip. Prolabium pared quadrilaterally.

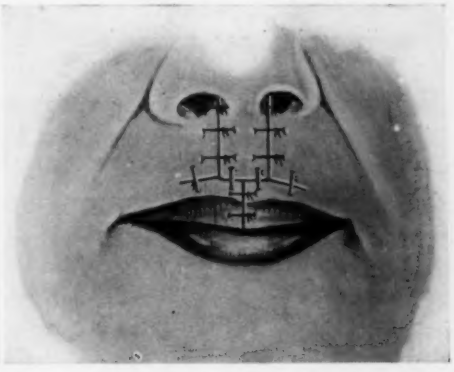

FIG. 12.—Flaps from cleft sutured beneath prolabium.

cially if the inter-maxillary bone had been damaged or removed. To overcome this deformity we have resorted to a method devised by the late Doctor Abbe, who recommended making a vertical incision in the mid-line of the upper lip and filling in the defect with a V-shaped pedicle flap from the lower

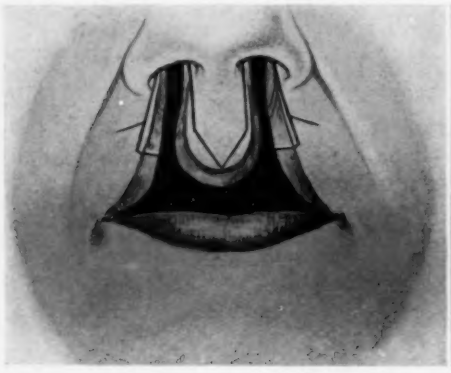

FIG. 13.—Schematic incision for double hare-lip with triangular paring of prolabium.

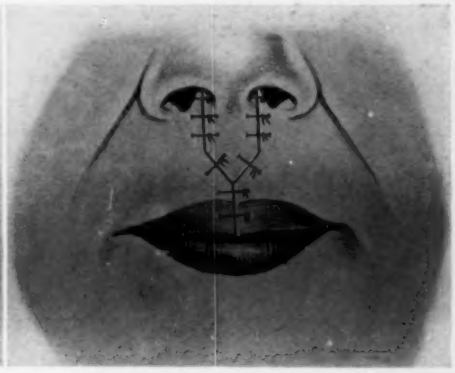

FIG. 14.—Edges of cleft sutured vertically beneath apex of prolabium.

lip. After incising the upper lift in the mid-line nearly to the septum and estimating the amount of tissue necessary to fill in the defect, a V-shaped flap is outlined in the lower lip. Starting at the mucous membrane one centimetre to one side of the mid-line the incision is carried obliquely downward and inward for a distance equal to the length of the incision in the upper lip. The opposite side of the V-flap is now cut upward and outward, stopping at a point before the inferior coronary artery is reached. The location of this

vessel is easily ascertained from its position on the opposite side, which has already been divided. This flap of lower lip is now swung on its pedicle so that the apex of the V is inserted into the apex of the defect and the adjacent raw surfaces sutured. The incision in the lower lip is now partially closed and a suture is passed through the two lips on the pedicle side to insure immobility of the flap. Feeding is carried out through a tube between the lips of the opposite side. In ten days to two weeks' time the pedicle is divided, the lower lip revised as much as is necessary to obtain an accurate approximation and the mucous membrane of the flap sutured to the mucous membrane of the upper lip after any necessary revision.

Cleft Palate.—Many operations have been devised for the cure of cleft palate. Brophy's method of forcibly approximating the two maxillary processes and holding them together with metal plates and silver wire at an early age has been generally discarded. Aside from the fact that many tooth buds were destroyed this method in no way restored the normal alveolar curve and led to a narrow and contracted arch. Lane's operation of hinging a flap from one side and interposing it between the muco-periosteum and bone of the opposite side with an elaborate and complicated procedure on the soft palate was ingenious, but it of necessity led to a rigid soft palate and occasional shrinkage so that the end-results, as far as speech was concerned, were disappointing. We used this method in a few of our earlier cases but have long since given it up. Dorrance, who has recently described a method of lengthening the soft palate by sliding the muco-periosteal flaps of the hard palate posteriorly, having fractured the hamular processes, feels that if the soft palate has been sufficiently elongated and relaxed it will insure satisfactory closure of the nasopharynx and permit satisfactory speech. We have not tried this method, but believe that it may hold great promise. The majority of surgeons feel that Langenbeck's operation gives the most satisfactory results and it has stood the test of time. There are many modifications of his technic; in fact every surgeon proceeds in a different way but the principles remain the same and we have employed it in practically all of our cases.

The successful closure of any cleft palate depends on approximating the tissues without tension. This can be done only if the arch of the palate is of sufficient height to allow the flaps when freed to drop down so that their edges may be approximated; second, by making sufficiently long relaxing incisions on either side just within the alveolar process to allow the edges to be brought together without tension; and third, to relieve all strain on the suture line by holding the flaps in apposition during the healing period by silver bands or other mechanical devices passed through the relaxing incisions.

Complete Cleft Palate.—Lateral incisions are made through the muco-periosteum mesial to the alveolar process on either side of sufficient length to allow suitable periosteal elevators to be introduced and the muco-periosteal flaps separated from within inward until the cleft is reached. Bleeding is easily controlled by packing. On reaching the cleft the elevator is pushed

through the margins of the flap. We prefer to start the separation through the lateral incisions rather than from the edges of the cleft as we feel by this method there is less traumatism to the tissues at the edge of the cleft which must be sutured. The attachment of the soft palate to the bone is divided with curved or right-angled scissors and then we are able to estimate how easily the two flaps can be approximated and, if the soft palate is sufficiently relaxed, to reach the posterior pharyngeal wall. This relaxation is essential to prevent subsequent regurgitation of food into the nasopharynx and to insure speech approximating normal. The edges of the cleft in the soft palate are pared with a sharp thin-bladed scalpel. The margins of the cleft in the hard palate are already denuded by the above method of separation but irregular or frayed edges should be revised. If the flaps are not easily approximated the liberating incisions can be carried more posteriorly and if necessary around the maxillary tubercle. Secondary relaxing incisions are made in the soft palate and two metal bands of silver, as advocated by Vaughan, are passed through the incisions, the first through the incisions in the soft palate and the second through the incisions in the muco-periosteum. The edges of the flaps are now sutured with interrupted transverse mattress sutures which begin at the uvula, one or two being passed through its superior surface. This method of closure secures approximation of the entire thickness of the flaps with accurate approximation of the mucous edges. If there is difficulty in closing the anterior part of the cleft this may be left until a later time. (Figs. 15, 16, 17, 18, 19, 20, 21, 22 and 23.)

The operation is completed by suturing together the ends of the metal bands. We believe these bands serve several useful purposes: 1. Tension is removed from the suture line. 2. The individual's tongue is prevented from pressing directly on the suture line. 3. The strain on the suture line is prevented from early adhesions which form between the muco-periosteal flap and bony palate. 4. The silver bands exert to some degree an antiseptic action in a field rich in contamination.

The method of closure of incomplete clefts is similar to that of the complete. If only the soft palate is involved the separation should be started in the muco-periosteum of the hard palate to allow the latter to drop down, thus relieving the tension and facilitating the division of the aponeurosis attaching the soft and bony palates.

If it has been impossible to close the anterior part of the cleft at the original operation, or as not infrequently happens in our experience, the anterior portion has failed to unite, the resulting sinus may be rather inaccessible due to the fact that it lies at the apex of a funnel-shaped depression. While liberating lateral incisions with separation of the muco-periosteum will usually give sufficient relaxation to allow the introduction of the sutures, we prefer to approach this problem by the following method. An incision is made in the muco-periosteum, at right angles to the aveolus in the region of the first molar tooth, long enough to allow the introduction of a suitable periosteal elevator; the muco-periosteum is then separated

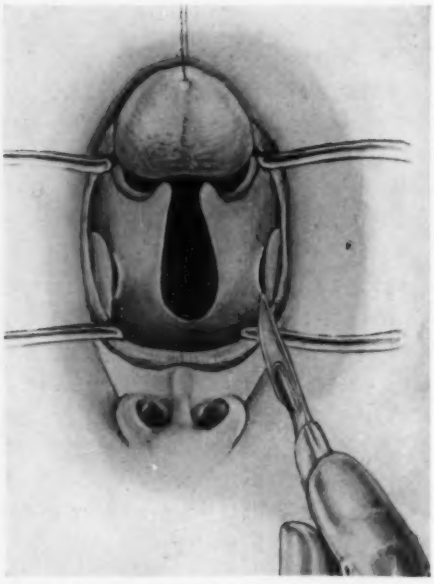

FIG. 15.—Lateral incisions through muco-periosteum mesial to alveolar process.

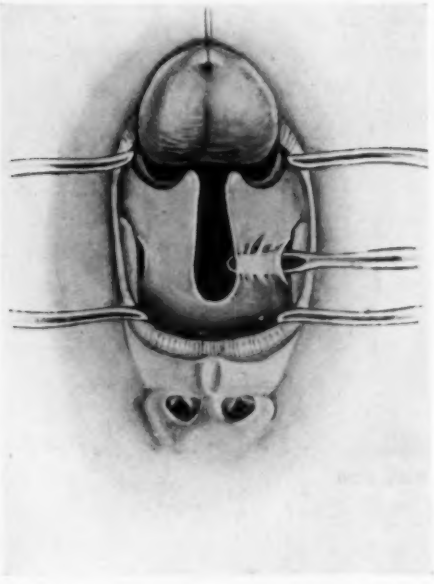

FIG. 16.—Separating the muco-periosteal flaps from without inwards.

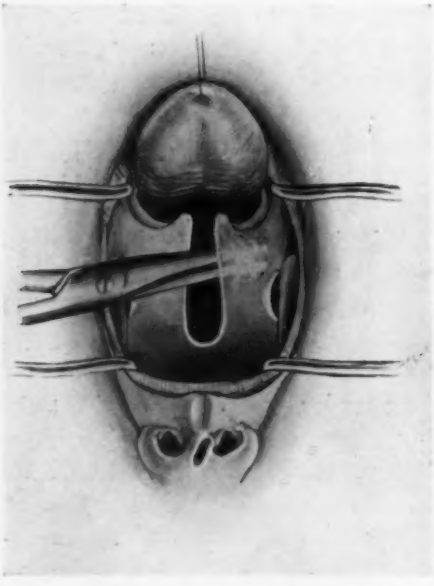

FIG. 17.—Division of attachment of soft to bony palate.

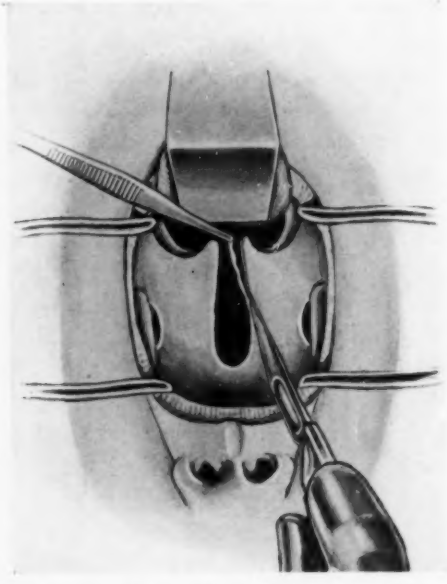

FIG. 18.—Paring the cleft of soft palate.

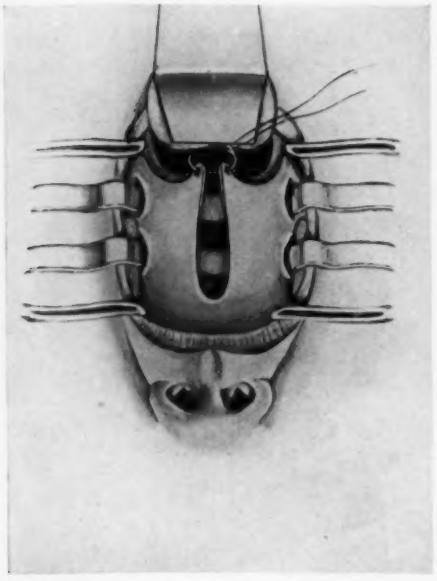

FIG. 19.—Additional relaxing incisions in the soft palate and insertion of silver bands. First suture in uvula.

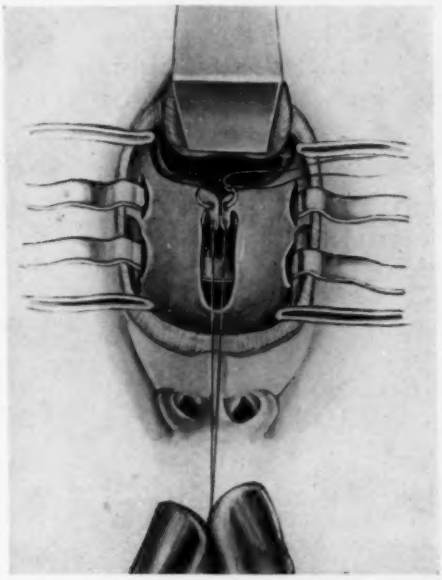

FIG. 20.—Suturing superior surface of uvula.

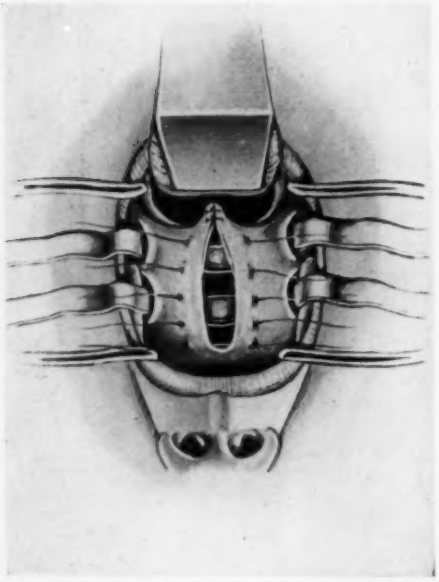

FIG. 21.—All sutures introduced.

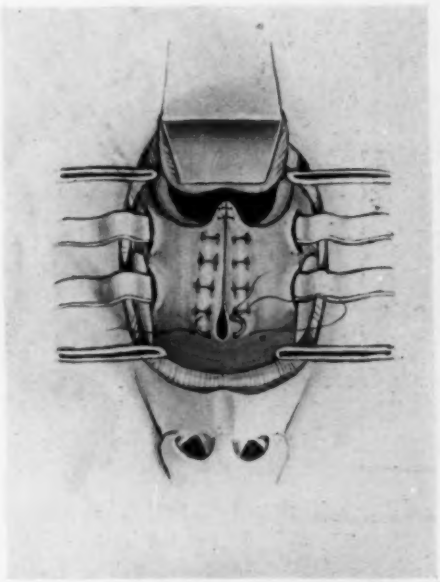

FIG. 22.—All but last suture has been tied. The latter shows the completion of the horizontal mattress suture.

from the teeth and palate around to the opposite side, thus forming a semi-circular flap which drops down, making the opening easily accessible. The edges of the sinuses can then be denuded and the sutures easily inserted and tied without causing tension after which the flap is returned to its normal position where it remains without additional mechanical aid. (Figs. 24, 25, 26, 27 and 28.)

Post-operative Care.—1. The foot of the bed is elevated to aid in the discharge of blood and mucus.

2. A hypodermocylsis of saline or glucose solution is given after the patient has reached the ward, the amount depending on the age of the child.

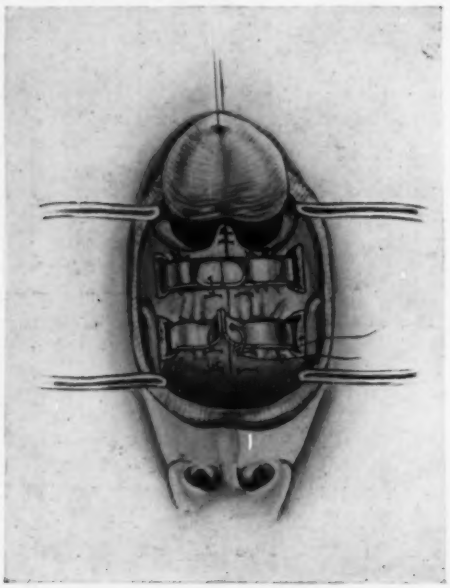

FIG. 23.—Operation completed by suturing the metal bands.

3. The hands of the patient are restrained until the sutures are removed.

4. The pulse is taken every fifteen minutes for the first two hours and the temperature every hour for the first two days.

5. The nose is kept clean to prevent the discharge from getting into the suture line in hare-lip cases.

6. Feeding (*a*) about two hours post-operative the patient may have small amounts of sterile water through a medicine dropper or a Breck feeder. Nothing but water is allowed for the first two days and the nurse gives as much as the child can tolerate.

(*b*) Orange juice, strained thoroughly, milk, and other liquids are given with a medicine dropper or Breck feeder on the third post-operative day and the child is not allowed to nurse from the breast or nipple for at least two weeks. No solid food is permitted until the sutures are removed.

(*c*) The mouth is irrigated with normal saline or boric acid after each feeding.

The sutures are removed in seven to ten days in the patients with hare-lip; the silver wire through the alveolus in two weeks.

In the cleft palate cases the metal bands are removed between the tenth and twelfth day and the sutures soon after.

Results.—The results in the cases with hare-lip are usually satisfactory. Occasionally some irregularity of the vermilion border may result which will have to be corrected at a second operation. The reformed nostril is occasionally too large and there may be a flattening of the ala nasi, but as we have gained in experience, paying more attention to the reforming of the floor of the nostril and making a more radical separation of the attachment of

FIG. 24.—Incision in muco-periosteum at right angles to first molar tooth.

FIG. 25.—Introduction of periosteal elevator. Separation of muco-periosteal flap started.

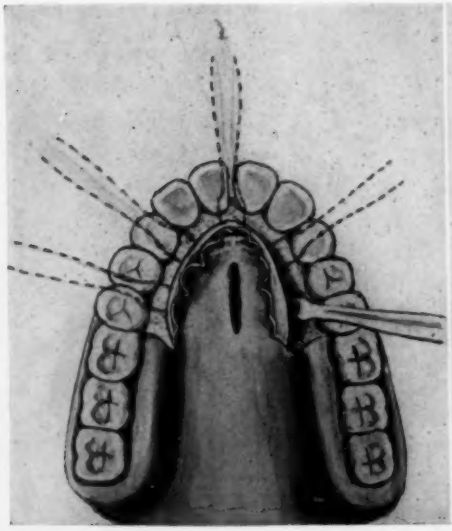

FIG. 26.—Separation of muco-periosteal flap around to opposite side.

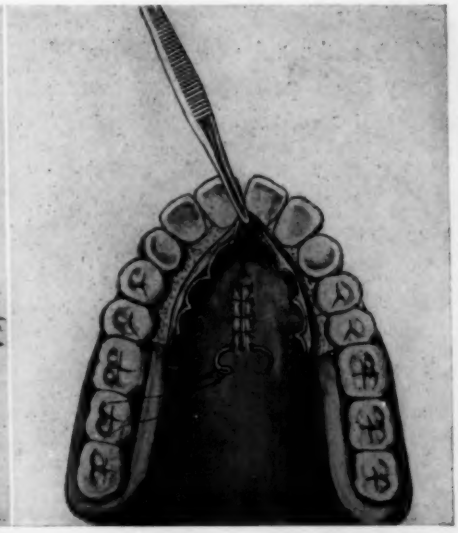

FIG. 27.—Margins of sinus have been pared. Sutures introduced and flap returned to its original position.

the ala to the maxilla, the cases requiring secondary revision are much less frequent.

Repair of Hare-lip.—(*a*) Unilateral complete hare-lip:

Single operation	good		12
(not re-operated)	improved		2
Two operations... first one fair, final result good			5
Five operations... first one failed, last result good			1

(*b*) Unilateral incomplete hare-lip:

Single operation	good		20
	improved		1
Two operations... first one fair, final result good			4

(*c*) Bilateral complete hare-lip:

Single operation	good		2
	improved		1
Two operations	fair		2
Three operations	fair		1

(*d*) Bilateral incomplete hare-lip:

Single operation	good		1
	improved		2

(*e*) Previously repaired hare-lip:

Single operation	Unilateral	good	6
	Bilateral	good	1

(*f*) Hare-lip, no description given ..... good 1

Repair of maxilla or alveolus alone ..... good 1

improved 1

The end-results in the cure of cleft palate are most discouraging. In twenty-three patients with incomplete clefts, which are undoubtedly the easiest to cure, we had only nine good results. Five others were classified as poor and nine were improved, which means that they were left with a small sinus or some separation of the soft palate.

FIG. 28.—Operation completed.

The results were poorer in those with complete clefts. Twenty-two patients were operated upon with only six good results and the majority of these required more than one operation. Eight were improved and seven were classified as poor, which meant a complete failure. Many of these were operated upon at too young an age, others had too wide a cleft and a fair proportion of the children came to us early in the series before we had acquired sufficient experience. Since us-

ing the metal bands our results have improved but they are still far from satisfactory.

Repair of Cleft Palate.—(*a*) Incomplete cleft palate:

Single operation	good	8
	improved	4
	poor	4
Two operations	good	1
	improved	4
	poor	1
Three operations	improved	1

(*b*) Complete cleft palate:

Single operation	good	1
	improved	4
	poor	4
Two operations	good	3
	improved	1
	poor	2
Three operations	good	1
	improved	2
	poor	1
Four operations	good	1
	improved	1

(*c*) Previously repaired cleft palate:

Single operation	good	1
	improved	1
	poor	1

(*d*) Cleft palate, no description given:

Single operation	poor	1
Two operations	improved	1

Repair of Hare-lip and Cleft Alveolus.—(*a*) Unilateral hare-lip and cleft alveolus:

Single operation	good	14
	improved	4
	poor	1
Three operations	poor	1

(*b*) Bilateral hare-lip and cleft alveolus:

Single operation	good	3
Separate operations on lip and alveolus	good	4

Deaths.—Nine patients died within the first twenty-four hours. Six of these were operated upon for cleft palates at ages varying from eight months to four years. All of these had temperatures ranging from 106° to 108°. We assumed that this sudden fatal termination with hyperpyrexia was due to aspiration of blood, but in one patient who was autopsied, the lungs were found to be clear. No other clinic has mentioned similar catastrophes and we are at a loss to explain this condition, unless it is due to absorption from the traumatized surface of the separated muco-periosteal flaps. The other three deaths were in cases of hare-lip in two of which the alveolus was moulded and wired. Two of these patients had high temperatures, the eti-

ology of which is as obscure as in those with cleft palate. Nine deaths occurred three to twelve days post-operative, the majority from pneumonia and ten patients died within two or four weeks from malnutrition.

There was a total of twenty-eight deaths in the 139 patients operated upon. Of these eighteen were directly due to the operation and in ten others it is fair to assume that they were not in proper physical condition to stand surgical intervention, inasmuch as they died in two to four weeks' time from malnutrition. Better judgment in the selection of these ten cases might well have eliminated the majority of these deaths.

In studying the pre-operative and post-operative mortality, we have endeavored to prove that a certain proportion of patients (12 per cent.) will die before their physical condition permits any operative procedure to be considered. A certain number will die from the operation (10 per cent.) and unless extreme care is exercised in selecting the ideal time for the operation there will be an additional mortality from malnutrition (6 per cent.).

Speech.—As stated before, all these children must be labored with both by parents and teachers trained in the correction of speech defects. With a little instruction the parents can readily learn to teach the child how to pronounce the more difficult letters and words and we have had some very gratifying results, even in those cases in which the palate was rigid and contracted. The improvement is obvious in adults, who are fairly intelligent and will make the effort to attend a school for speech correction.

CONCLUSIONS

(1) The lip and alveolus should be repaired as soon after birth as the infant's physical condition will permit.

(2) Operations on the palate should be postponed until the child is at least three years old. Do not operate before the cleft is narrow enough to assure reasonable success irrespective of age.

(3) Early closures of the palate do not facilitate correct speech in our opinion, and just as satisfactory phonation may be obtained in the late closures if the individual receives the proper training.

(4) A good cosmetic result is possible in nearly every case of hare-lip providing the parents will not lose confidence in the surgeon if the first operation proves unsuccessful.

(5) The results in the operations for cleft palate are far from satisfactory. Selection of the ideal time as regards age and width of cleft will avoid a certain number of failures.

For discussion see pages 136-140.

PLASTIC RESTORATION OF THE ŒSOPHAGUS

By L. Dengel, M.D.
of Lodz, Poland

As far as I can learn, forty-nine cases of plastic surgery of the œsophagus have, up to this time, been described in medical literature. Many surgeons have operated with various methods. The first operation of this kind was made by Bircher and Roux, who devised two principal methods of making an artificial œsophagus. Roux, in 1907, made a complete œsophagus from the thin gut and, carrying it out under the skin of the breast, joined one end with the stomach and the other end with the remaining portion of the natural œsophagus which he had prepared in the neck. This case was successful. Bircher tried to make a complete œsophagus from the skin of the anterior breast wall, but as his patient was suffering from cancer, Bircher lost his patient before the operation was completed.

These two attempts encouraged research for new ways of modifying this particular operation. Instead of the thin gut other organs were tried, *i.e.*, the thick gut and the stomach (Hæker-Kirschner). A complete œsophagus was made from skin and, again, part of the œsophagus was made from the skin and the rest from the abdominal organs (Lexer-Blanel).

I do not wish to describe these operations, interesting though they may be. I wish here only to describe my own case, which was made after Jianu's method with Rutkowski's modification, a method which has not yet been described in medical literature.

As we know, Jianu, in order to make an artificial œsophagus, also used part of the stomach, namely, the large curvature. He separated the stomach from the transverse colon by tying the ligamentum gastrocolicum. The large curvature, which was separated from the rest of the stomach by two forceps, was severed in the region of the pylorus and gradually cut toward the cardiac. The severed part of the stomach with its artery, *i.e.*, gastroepiploica, on the left side, was reversed to make a tube and was sewed and carried out under the skin in the region of the neck. The remainder of the stomach was simply sewed in the ordinary way.

Rutkowski modified the method of Jianu in the following way. He made the tube from the cardiac side so that this tube was nourished by the arteria gastroepiploica dextra. A tube constructed in this way from the right side is better fitted than the one from the left side—Jianu—because the arteria gastroepiploica dextra is larger and, what is in my opinion more important, the apex of the tube is made from the cardiac part of the stomach where the mucous membrane has not the same peptic qualities as that from the pyloric region. I emphasize the importance of this because the union of the two tubes is facilitated by the fact that ulcers do not appear at the junction of the tubes.

CASE.—W. K., aged eighteen, June 6, 1925, drank hydrochloric acid. She drank, as she herself related, four mouthfuls. Immediately afterward she drank cold water. Next day she vomited with blood. For the next three months she was treated in the hospital for internal diseases. During the first month a constriction appeared in the gullet and in hospital they tried to dilate this constriction with a sound. She could swallow fluid food only with great difficulty. During the first year of treatment her condition fluctuated greatly. Sometimes she could swallow fluid food with ease and at other times she could not even swallow water.

June 20, 1926, she was admitted to hospital. The exploration of the œsophagus with the probe showed that the constriction was 18 centimetres from the teeth. At this point the 6.8 millimetre probe stopped. X-ray examination showed that the barium in the œsophagus stopped at the point of the jugulum. (Fig. 1.) We see the dilation of the œsophagus as large as a pigeon's egg, and from this point the barium flows in a thin stream to the stomach.

FIG. 1.—The photograph shows the point of constriction of the œsophagus.

FIG. 2.—The photograph shows the Jianu-Rutkowski operation demonstrated on a specimen stomach.

On the day of admission to hospital her weight was only thirty-seven kilograms, mainly because of inadequate feeding. For several days she had to be prepared for operation with injections of sugar and heart stimulants. June 25, 1926, I began to operate under ether anæsthesia. The abdominal wall was opened in the middle line above the umbilicus. The stomach was not large. First I separated the ligamentum gastrocolicum and the ligamentum gastrolienale from the stomach. Then I fastened the forceps on the stomach parallel to the large curvature, and in the direction of the pylorus. Then I cut the large curvature, both anterior and posterior walls, gradually sewing both stomach and large curvature, which was partially cut away from the stomach, and which I reversed to form a tube. This tube was supplied by the arteria gastroepiploica dextra.

Rutkowski made this operation four times, Jianu once, and I also once, and gangrene of the new tube occurred in none of these cases. This is contrary to the experience of Hesse, who took the tube from the left side of the

large curvature. I must emphasize that the stitching of the tube must be done very accurately so that a constriction may not occur in the new œsophagus. It is also very important to liberate the pylorus so that the stomach may be raised and the new œsophagus carried higher up under the skin. Before carrying the tube out underneath the skin it is important to close the apex of the tube very carefully so that infection does not occur. For this purpose I made a channel under the skin on the breast bone with an opening at the junction of the third rib (left side) and the breast bone, and sewed the apex of the tube to the skin of the opening.

The abdomen was sewed in the normal way and the stomach fixed at the top of the opening to the peritoneum. After twenty-four hours, the apex of the tube was opened

FIG. 3.—Appearance of the patient two weeks after gastro-œsophageal plastic.

FIG. 4.—The diagram shows the patient after the second act of operation. The two openings of the œsophagus are connected by the rubber drain.

and a rubber drain was put into it and the feeding of the patient was now begun. Fluid food was easily absorbed by this means and the patient soon lost the feeling of hunger which she had constantly felt during the preceding months.

The patient recovered quickly from the operation. The very small rise in temperature, which was never above 38°C., disappeared after one week. The wound healed well and ten days after the operation the stitches were removed.

November 10, 1926, the second act of operation, left-sided cervical œsophagostomy, was carried out. Under ether anæsthesia, a skin incision was made along the anterior edge of the sternocleidomastoid muscle, which was moved back. As the thyroid gland was abnormally large and hindered the separation of the œsophagus, the left lobe was removed. After this had been done, the œsophagus could be more easily separated and moved toward the wound. The edges of the skin were sewn to the

œsophagus and the œsophagus itself in this act of operation was not opened; but the wound was filled with gauze so that it remained quite aseptic.

After two weeks, when the edges of the wound had grown firmly to the œsophagus and the stitches had been removed, the œsophagus was opened to the length of 4 centimetres. At the same time a rubber drain was inserted in the opening of the new œsophagus.

At this stage the patient could feed herself. She could drink fluids and eat solid foods, meat, vegetables, etc. The patient improved both physically and mentally, and, being now able to eat and drink without assistance, she recovered her good humor and interest in life. January 2, 1927, her weight was fifty kilograms.

June 9, 1928, the third act of operation was performed. The purpose of this was to connect the two openings with a tube made from the skin of the anterior breast wall. The distance between the two openings was 14 centimetres. For this purpose a skin incision was made, one fingerbreadth to the right of the two fistulæ. From this first incision were carried two other incisions across, one a fingerbreadth above the upper opening and the other a fingerbreadth below the lower opening. The two cross incisions were connected on the right side of the two fistulæ so that the upper end of the patch of skin was three fingerbreadths in width and the lower edge four fingerbreadths wide. This patch of skin was separated along the left side to the middle. Then it was reversed to form a tube and was sewn with the right edge. For stitches only fine catgut was used.

FIG. 5.—The patient one month after completion of operation.

Before this skin channel was closed a rubber drain was put through the nasal aperture into the stomach, and by means of this tube the patient was fed after the operation. So there was made a closed tube with the skin reversed containing two fistulæ. Both the exterior wall of this tube and the wound from which the tube had been made were covered with skin taken from the neighboring area. The edges of the skin were first prepared and then sewn over the tube. After this operation the patient was feverish during one week, the evening fever being as high as 39°C. Pus came out between the stitches. Unfortunately, the stitches were taken away too early and after ten days all the cylinder had unrolled.

In order to have material for a repetition of this operation, I was obliged to sew the patch of skin back into its former position. The patient was sent home for some months and during this time the skin was massaged. Soon its former elasticity and movement reappeared. In this way I procured the *status quo* for my next operation.

April 15, 1929, the plastic operation was repeated and the channel was again made from the skin in the same manner as before. Before the channel was covered by the neighboring skin and sewn over, two perpendicular incisions were made on both sides of the breast. In this way the skin was given more play and was not so tight over the channel. After this operation all the channel grew together well save for one small fistula which appeared at the connection of the skin channel with the œsophagus made from the stomach; but this after some time also healed up and disappeared.

After this operation the patient was feverish during two weeks so that the evening

temperature was 39°C. This necessitated a skin incision on the side of the channel a little below the clavicle, and another incision at the point of junction of the channel and stomach. Through these two incisions a little pus and some gangrenous fat came out. A month later the upper wound had healed well but the other persisted. Here there formed a fistula 5 millimetres in diameter which was covered both inside and out with skin. September 4, 1929, with local anæsthesia this fistula was sutured, and by October 1 the wound had healed completely.

It is clear that such a channel made from skin and connected on one side with the œsophagus and on the other with the stomach could not heal *per primam intentionem* because of the fact that both from the œsophagus and the stomach infectious materials pass into the channel—saliva from the mouth and food from the stomach. In order to avoid this infection, the external

FIG. 6.—X-ray of new œsophagus, barium filled.

FIG. 7.—The stomach filled with barium. The œsophagus is partly filled and the barium then passes into the duodenal part of the stomach.

stitches in the skin over the channel must be put far apart and not too tightly drawn. As I have mentioned above, the first attempt at making the channel was unsuccessful. This was undoubtedly due to the fact that the operator had not make the two incisions so as to give more liberty to the skin, and thus the stitches were too tight. This, together with the collection of pus, which in this case was quite normal, caused the unrolling of the skin cylinder. For these stitches only very fine wire was used.

Two years and two months after the first day of operation, the artificial tube was completed. (Fig. 5.) During this time four operations were made under ether anæsthesia and one minor operation under local anæsthesia. This is, of course, a long time for such an operation, and it is certain that this operation could be performed in a shorter time. The period of time between two acts of operation in my case was too long. The state of the patient did

not necessitate these long intervals; they were caused by other reasons which need not be mentioned here.

Three months after completion of the operation, the patient's weight was fifty-five and one-half kilograms. She now took food quite freely, eating meat, vegetables, raw fruits and warm and cold fluids, without any feeling in the skin tube. Histological examination, carried out by Müller on such an artificial œsophagus made from the skin in the case of a patient who died four years after the operation, showed that the skin, while retaining all its anatomical properties microscopically, looked quite smooth and white as if it adapted itself to its new rôle.

The X-ray examination of the new œsophagus (Fig. 6) shows that the barium under pressure of the mouth and throat passes quite rapidly to the point of junction with the stomach tube and there it can be seen that the barium does not stop but continually fills the œsophagus. This proves that from this point peristaltic movement begins.

It would be very interesting to know, (1) what is the deformation of the stomach after the large curvature has been cut away; (2) if the stomach regains its normal shape after some years; (3) if the food goes immediately to the duodenum or if the stomach is first filled with food and then gradually emptied, and, (4) if the food does not stop on the bottom of the stomach, as might be supposed when we remember that the duodenal part of the stomach was turned 90° on the horizontal part of its axis when the stomach tube was put up under the skin. For this purpose I made the X-ray diagram (Fig. 7) which shows that the stomach has its normal contour. It is filled with barium which gradually passes into the duodenum, and two hours afterwards the stomach showed only traces of barium.

THYROGLOSSAL CYSTS AND SINUSES

By Howard M. Clute, M.D., and Richard B. Cattell, M.D.

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From the Lahey Clinic

With normal development the thyroglossal tract becomes completely obliterated before birth. When a portion of this tract remains, it may occasionally give rise to a cyst or sinus, and, rarely, to a congenital fistula. Arrest in the development of the thyroid gland may result in this gland remaining in an aberrant location, somewhere along the course of the thyroglossal tract. Very rarely malignant tumors may arise from the epithelium of the tract.

There have been seventy-four cases of thyroglossal tract abnormality treated in the Lahey Clinic up to January, 1930. During this time 6582 cases of thyroid disease were treated. This gives an incidence of approximately one case of thyroglossal tract abnormality to ninety cases of thyroid disease that we have seen. Thyroglossal cysts are probably seen relatively more frequently in a general surgical clinic where fewer thyroid cases are seen.

Diseases of the thyroid gland are now generally well recognized, but abnormalities associated with the origin of the thyroid gland (that is, abnormalities in the thyroglossal tract), have received less attention. Néris,[1] in his prize thesis of 1929, entitled "Le tractus thyréoglosse," has reported the subject thoroughly with particular reference to the cases observed in the Paris hospitals. His book includes a review of the cases reported in the literature, together with a bibliography of nearly 600 references that includes all related subjects. Bailey,[2] in 1929, reported a study of 124 cases seen chiefly in the London hospitals, some of which he had observed personally. Sistrunk[3] reported thirty-one cases from the Mayo Clinic in 1920, and described a new operative procedure for their cure. This operation has come to be widely adopted. Klingenstein and Colp[4] reviewed the subject in 1925 and reported an additional forty-two cases. In addition to these papers there have been several other reviews and case reports.* We plan to report the treatment of these cases in the Lahey Clinic, and to present the results of this treatment from a follow-up study of fifty-eight of these patients.

For an extensive study of the embryology of the thyroid gland we would refer to the excellent reviews by Wenglowski[5] and by Norris.[6] We will briefly recall the origin and descent of the thyroid gland, however, in order that the course of the thyroglossal tract may be sufficiently in mind for the purposes of this paper. The thyroid gland arises as an out-pocketing in the pharynx between the first and second branchial arches. This position is marked in adult life by the foramen cæcum at the base of the tongue. The

* The authors have reviewed twenty-one additional papers, but these are not included in the bibliography.

thyroid body descends in the mid-line through the tissue which later becomes the hyoid bone, but since the hyoid bone develops at the time of, or after, the descent of the thyroid gland, the thyroglossal tract may vary in its relation to the hyoid bone. It may pass in front of the hyoid bone, behind it, or through its substance. There has been considerable discussion of this point, but for practical purposes it makes no difference in the treatment. Néris,[1] in reviewing the reports on this point, believes that the view that it is anterior to the hyoid is correct. Normally, this thyroglossal tract disappears during fœtal life. When the tract is not obliterated, however, various anomalies occur which depend upon the location and the extent of the thyroglossal duct vestiges.

The rarest anomaly associated with the tract is the failure of the thyroid gland to descend into the neck. The entire structure may never leave its point of origin in the pharynx, and may persist at the base of the tongue as a lingual thyroid gland. We have had two cases in this clinic of proven lingual thyroid gland which have been reported previously.[7, 8] Néris [1] was able to find a report of twelve such cases, the first being reported in 1853.

Still-born and non-viable myxedematous babies may have no development of thyroid tissue, and may have only an irregular epithelial cystic mass at the foramen cæcum.[9] In other cases where the thyroid gland has descended into its normal position, small remnants of thyroid tissue have been found in the foramen cæcum. In other rare instances, the thyroid gland descends partially into the neck but never reaches its normal position, and a swelling persists between the thyroid cartilage and the hyoid bone, or above the hyoid bone, which is a solid tumor made up of thyroid tissue. If this is all the thyroid tissue the patient has, removal may result in myxedema as has been previously reported.

The most common abnormality arising in the thyroglossal tract is a simple cyst or sinus. A thyroglossal cyst is a retention cyst resulting from desquamation and inflammation of the epithelial cells in a closed portion of the thyroglossal tract. By recurring inflammation such a cyst may increase markedly in size in a short time, and it is well recognized that these cysts are peculiarly prone to inflammation. This suggests the thyroglossal tract as the portal of entry for the organisms present in the mouth. There is no logical basis for this, however, since in few cases can any direct communication with the foramen cæcum be demonstrated. Thyroglossal sinuses opening in an anterior location in the neck result from the spontaneous rupture of a thyroglossal cyst due to inflammation, or they result from the surgical drainage of the cyst. A true congenital fistula opening into the base of the tongue may occur. Bailey [2] was able to find but two of these that were actually congential. Néris [1] found six additional congenital cases. Typical history of this fistulous condition, not of the congenital type, was presented by a woman, fifty years of age, who complained of periodic discharge of pus into her mouth. This had been present for four months. On examination a cyst was found present in the supra-hyoid region. Pressure on it caused

a discharge of pus into her mouth, which produced the chief complaint. The discharge could be seen to enter the mouth at the base of the tongue. Bailey [2] reports thirty-two patients with this lesion, including the cases of Freer [10] and of New.[11] The latter was able to demonstrate the communication by X-ray after the injection of a barium mixture. Takeda [12] demonstrated the extent of a fistula by X-ray in 1922. All thyroglossal sinuses and fistulæ opening on the neck are secondary to preëxisting thyroglossal cysts, and for this reason all of these cases will be discussed together. Fifty-eight patients have been followed more than one year after operation, so that this number will be considered in this report.

Sex.—In our experience with thyroid disease the incidence of female to male patients is in a ratio of 7 to 1. In anomalies of the thyroglossal tract, however, this predominance does not exist. Thirty-eight of our patients were females, and twenty-two were males, making the ratio less than 2 to 1. Klingenstein and Colp [4] found thirty-one males and eleven females in forty-two cases, while Bailey [2] found seventy-two females in 117 cases.

Age.—The youngest patient in this series was three years old, and the oldest was seventy-two. The average age for the group was thirty-three years. These figures represent the age of the patients at the time of their first examination.

TABLE I

Age Groups

1–10 years	3	40–50 years	5
10–20 "	7	50–60 "	7
20–30 "	11	60–70 "	2
30–40 "	19	70–80 "	1
		Not stated	3

Duration.—Of this entire group of fifty-eight patients only eight, or 13 per cent., were discovered before ten years of age. One of these was noticed at birth, and another at the age of three months. Bailey [2] states that in ninety-two cases that he reviewed, the greater majority were in babies and infants, while only nineteen of the ninety-two were discovered after twenty years of age. Klingenstein and Colp's [4] experience was similar, with thirty-one of forty-two cases being under twenty years of age at the time of operation.

In forty-one of our cases, the first appearance of the thyroglossal cyst or sinus was noted on the history. In twenty-four of these it appeared after twenty-five years of age, one being found at fifty-seven and another at the age of seventy-one. The duration of the cyst before operation varied from four months to thirty-three years. Thus it will be seen that in our experience this abnormality was usually found in adult life. This is contrary to most reports. It must be appreciated, however, that the greater majority of patients at the clinic are adults.

Pathology.—In this group there were forty-one cysts, eighteen sinuses and one fistula. The size of the cysts varied considerably from tumors which

were barely palpable to one which was six inches in diameter (Figs. 1 to 4).

The contents of the cysts are generally of a mucoid character, but in long-standing cases they may contain necrotic material and cholesterin crys-

FIG. 1.—A small thyroglossal cyst.

FIG. 2.—There is a history of repeated inflammation with rapid increases in size.

tals. When infection is present the contents are purulent, and if the cyst is of long standing its wall is thickened by the repeated inflammatory changes. Osteomyelitis of the hyoid bone may occur, and has been found at operation twice in our experience. In both of these patients there had been long-

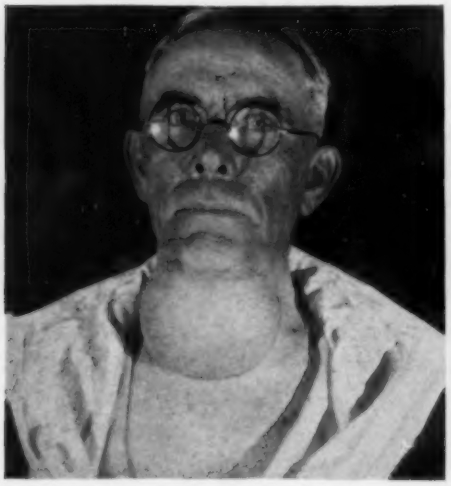


FIG. 3.—A large mid-line fluctuant tumor which moved upward with deglutition. A diagnosis of thyroid adenoma was made, but at operation it proved to be a thyroglossal cyst.

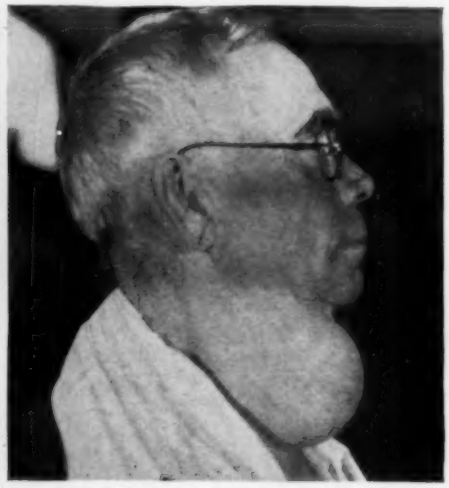


FIG. 4.—The lateral view of the patient shown in Fig. 3.

standing infection of a thyroglossal sinus. This osteomyelitis may delay healing and cause a persistent discharge of long standing. It may readily be confusing, since one is lead to believe that all of the tract has not been excised. It is also very disturbing because of the long duration of the marked induration that accompanies it.

Up to the level of the hyoid bone the cavity of these cysts is continuous, as a rule, with the structures of the thyroglossal tract from which it arises. At this point the tract is less obvious, and is often difficult to trace. As stated before, the tract at this point may be in front of the hyoid, behind it, or through its substance.

The microscopic appearance of these cysts is in keeping with their epithelial origin. They are lined with stratified squamous epithelium. Occasionally the epithelium is ciliated, and appears columnar. Following repeated inflammation at times only a fibrous wall may be demonstrated with no evidence of epithelium. In one instance in our experience thyroid tissue was found in the cyst wall. Néris [1] reports a similar case.

The thyroglossal sinuses may be lined with epithelial cells similar to those of the cysts. For the most part, however, these sinuses show simply a very

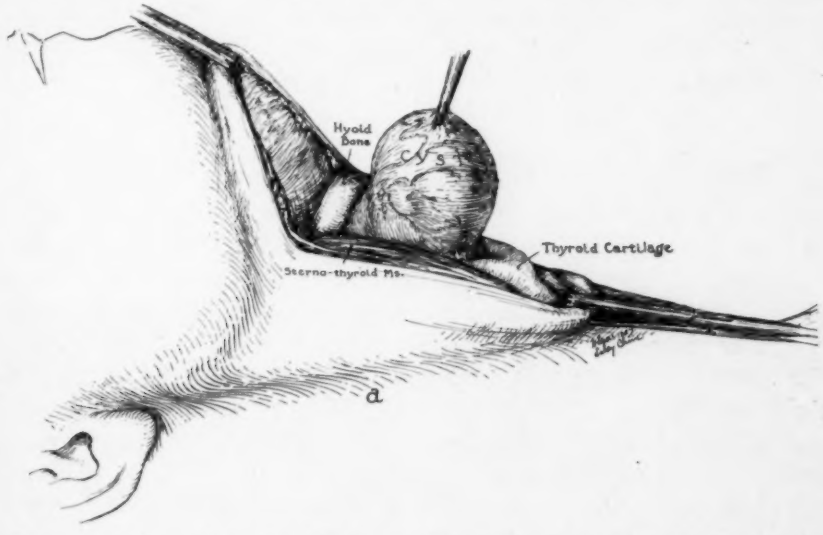


FIG. 5.—Drawing made at the time of operation, showing exposure of the cyst and its relation to the hyoid bone and thyroid cartilage.

marked chronic inflammation, with little or no microscopic evidence of epithelial tissue.

Epidermoid carcinoma arising in the thyroid gland probably has its origin in the thyroglossal tract. The occurrence of this type of carcinoma is quite rare. One such instance of squamous-cell carcinoma has been observed in the clinic [13] and has been previously reported. It is difficult to explain this type of carcinoma, except as arising from the thyroglossal tract vestiges. We have previously operated upon a boy who showed a development of early adenocarcinoma in a thyroglossal cyst. We have been unable to find a report of a similar finding in the literature. A brief report of this case follows.

A boy, six and one half years of age, came to the clinic in February, 1930, with a soft fluctuant swelling in the region of the hyoid. It had been noticed by his mother four weeks previously, when it was about the size of a marble. His mother associated its onset with a blow to this region. The usual radical operation was carried out.

Examination of the specimen showed the tract passing through the substance of the hyoid bone. Dr. Shields Warren reported that the cyst showed the usual epithelial lining, with chronic inflammation, but one portion of the wall showed adenocarcinoma. Sixteen days later the wound was reopened, resecting further portions of the hyoid as well as carrying out a more radical removal of the muscular planes, and Doctor Warren reported these specimens as showing no evidence of the growth. He will report this subsequently.

Location.—The most common location of these cysts is in the mid-line of the neck on the thyrohyoid membrane, lying in the sub-hyoid area. As they increase in size they may acquire an asymmetrical position, and lie to either side of the mid-line at different levels in the neck. Fraser [14] found a cyst incorporated in the hyoid bone to the left of the mid-line. He believes that the primary portion of the thyroglossal tract (that is, the thyrolingual portion) becomes obliterated early, while the portion at the hyoid branches into several buds that deviate from the mid-line. This can explain their position in other than mid-line positions, and is in agreement with the embryological findings of Norris.[6]

In a few instances the cyst has been so low that it was mistaken for an adenoma of the lateral lobe of the thyroid. Bailey [2] reports four instances where the cyst was found in the suprasternal notch. The location of the thyroglossal sinuses is entirely dependent on the original location of the cysts from which they develop, and on the point at which the cysts are incised. In the ninety-two cases reviewed by Bailey,[2] twenty-one were above the hyoid, and seventy-one were below it. We have observed no instance of a cyst or sinus occurring below the normal position of the thyroid. All of the thyroglossal cysts that we have observed have been in close relation to the hyoid bone, or definitely below it. Most of the sinuses have passed above the level of the hyoid, but less than half of them have shown a visible extension upward to the foramen cæcum.

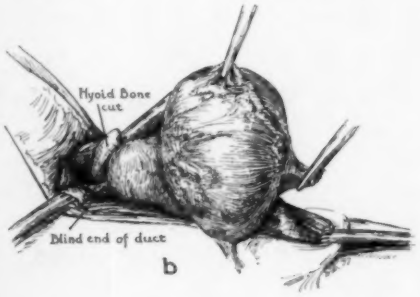
Symptoms.—Subjective symptoms arising in association with thyroglossal abnormalities are almost entirely related to the presence or absence of infection. A simple cyst is noted as a painless, non-tender swelling in the mid-line of the upper neck. Frequently the only complaint is that of unsightliness. When infection is present the cyst becomes tender, red and increases considerably in size. We have not observed the tendency of the infection to pass around the neck as a collar, as reported by Bailey.[2] There may be a considerable enlargement in a few days' time. With inflammation, deglutition may be painful; breathing has not been affected in our experience.

When the cyst is replaced by a draining sinus the constant discharge of mucus is annoying. Not infrequently the sinus heals superficially, and requires repeated incisions on account of retention of secretions and infection.

In thyroglossal fistulæ there are periodic discharges of mucopurulent material into the mouth when the cyst is compressed. In our case it was impossible to palpate the cyst after its contents had been discharged. This was true in the case described earlier in this paper, in which the cyst was palpable on the first examination, and discharged pus freely through the

foramen cæcum. Later examination failed to reveal the tumor previously felt. Operation was advised, and carried out on the basis of the preliminary examination and on the history.

The diagnosis of a thyroglossal cyst is dependent upon its mid-line position and its intimate relation with the hyoid bone, and on the fact that it moves upward with deglutition. These simple findings will establish the diagnosis in most cases. The diagnosis of a thyroglossal sinus depends upon the history of a preëxisting mid-line tumor, which has either ruptured or



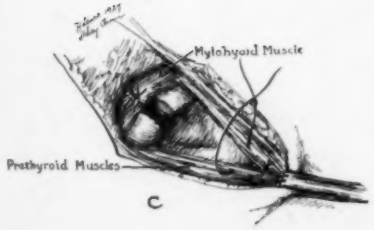


FIG. 6.—The upper drawing shows the hyoid bone divided with the ends retracted. The portion of the hyoid bone that has been excised is not shown. The tract extends upward above the level of the hyoid bone towards the base of the tongue. The lower drawing shows the operative area with the cyst and tract removed with interrupted sutures placed in the muscles. Rubber dam drain is brought out from the depths of the incision and the hyoid bone is approximated with interrupted sutures placed through the fascia and muscles surrounding the bone.

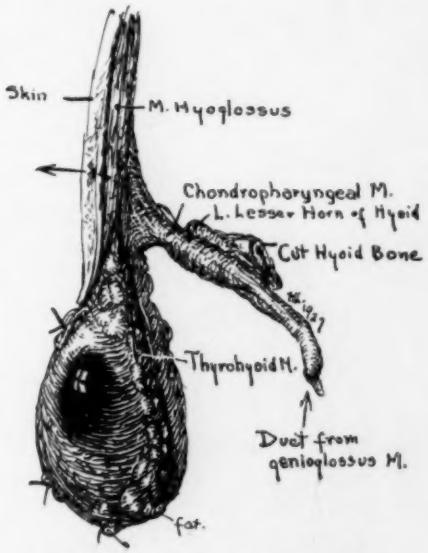


FIG. 7.—A drawing of a specimen of a thyroglossal cyst and its tract which have been removed at operation. In this instance, the tract was a definite structure that was easily followed.

was incised. Thyroglossal fistulæ opening into the foramen cæcum cannot be confused with any other condition. In certain cases it is possible to confirm the diagnosis of thyroglossal sinus or fistulæ by the injection of barium paste, lipiodol, or some other radiopaque substances with the use of the X-ray. In our experience, such a procedure proved painful and unsatisfactory, and it will rarely be necessary to establish the diagnosis.

There are relatively few lesions which occur in the region of the thyroglossal tract that could be confused with these cysts. A discrete tuberculous gland in the sub-mental region has been found a few times in our cases when the diagnosis was thyroglossal cyst. The differential diagnosis of

these two conditions is very difficult on clinical examination, and may be in doubt even at operation.

In a recent case a chronically infected cystic mass occurring in the subhyoid region was found, which was very difficult to prove to be a thyroglossal cyst. It did not seem to be attached to the hyoid. Nevertheless, the complete operation was carried out with the removal of the central portion of the hyoid. The pathologist reported it as a thyroglossal cyst. It is quite possible that such a patient would not be relieved by a simple excision.

FIG. 8.—A photograph of an excised thyroglossal cyst which had become a sinus from a previous simple incision. It can be seen that the tract becomes quite small, but that a core of muscular tissue has been removed with it. Arrow points to sinus opening in section of hyoid bone that was removed.

FIG. 9.—The thyroglossal cyst and tract excised from the patient shown in the second figure. It will be seen that a definite tract extended for an inch above the cyst, but that it was necessary to excise muscle tissue above it to the floor of the mouth in order to remove it radically. Results:—Cured.

A thyroglossal cyst has been found in two patients when the diagnosis of discrete thyroid adenoma had seemed assured. The cysts in these cases were in the position of the isthmus, and overlay it. A stalk ascended to the hyoid bone in each case, somewhat in the manner of a small pyramidal lobe. The operative diagnosis depended on this extension of the stalk, and was confirmed by microscopic examination.

Dermoid cysts have been encountered, and cannot be differentiated easily

from thyroglossal cysts before operation. Lipomata and wens might be confused with these cysts but can usually be differentiated. Neither lipomata nor dermoids are apt to move on deglutition.

Operative treatment.—Néris [1] found that Durham, in 1893, suggested division of the hyoid to give better operative exposure. Schlange first practiced resection of the median portion of the hyoid in 1906. The best description of a satisfactory operative technic was devised by Sistrunk [3] and reported in 1920. This is the radical operation which we have employed, and we would refer the reader to his article for the details of his operation. In brief, it consists of the complete removal of the cyst or sinus, the resection of the median portion of the hyoid bone, and the excision of a core of muscular tissue in the plane of the tract, up to the foramen cæcum.

Many methods have been used in the past to identify sinuses at operation. Silkworm gut and probes have been introduced, various dyes have been injected, and radiopaque materials have been used to have X-ray plates in the operating room showing the direction of the tract. The granulation tissue of the tract can usually be identified without these measures, and they all can now be discarded if the technic of Sistrunk is used.

Prior to our examination twenty-five of these fifty-eight patients had been operated upon. Nineteen patients had incision and drainage, among whom three were incised twice, and two were incised three times. Six had excision to the hyoid bone, one patient having three such excisions. It is important to note that in none of these twenty-five cases had a radical operation ever been attempted.

In our operative experience in the Lahey Clinic we have incised and drained four cases, each of which required later radical operation. In five patients excision was carried only to the hyoid bone, and two of these required later radical operation. Thus in our own experience six of these nine patients required later radical operation after the failure of lesser procedures.

End results.—The end results after the radical operation have been most satisfactory. There has been no operative mortality, and there has been no recurrence in the fifty-one patients followed who had this operation. Excision to the hyoid bone alone has proved unreliable, since in the five patients in whom this alone was done reoperation was necessary in two cases. Of the fifty-eight patients in this group, four could not be followed. Four were followed for less than six months, and fifty were followed for more than one year.

In the group of fifty-four patients who were followed, six complained of thickening in the scar. There was in these, however, no evidence of tumor and no discharge. In one patient who had osteomyelitis of the hyoid bone this thickening was one factor in a mental depression that culminated in suicide three months after operation. It has been necessary to excise an unsightly scar in one case.

SUMMARY

1. Thyroglossal cysts and sinuses are of relatively rare occurrence.

2. The diagnosis is made on the findings of a single mid-line tumor or sinus in the region of the hyoid bone, which moves with deglutition.

3. Operation may be advisable for unsightliness, a discharging sinus, and infection.

4. Incision and drainage should be done only in the presence of an acute infection, and with the understanding that later radical excision will be necessary for cure.

5. The radical operation is necessary to assure the cure of the thyroglossal cysts and sinuses. No recurrences followed its use in our experience.

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MULTILOCULAR CYST OF THE SPLEEN PRODUCED BY INFARCTS

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The diagnosis of certain affections of the spleen not seldom encounters insurmountable difficulties. It often occurs, in fact, that the real nature of a given splenic condition is revealed only by ablation of the organ. Splenectomy at present permits us to determine, with growing exactness, both clinical and anatomical modifications not only in the spleen, but in the liver, undiscoverable by any other method. We are well aware that conditions underlying certain types of splenic hypertrophy are not rendered positively clear, even after puncture of the spleen or removal of its pulp with a trocar especially designed for the purpose, and without mention of the several dangers occasioned to the patient by these procedures. It thus often occurs that, in view of the evident clinical complications, cases of splenic hypertrophy are operated without exact knowledge of the real pathological conditions present.

On account of these facts, some writers think that splenectomy should be done immediately, and without waiting for exact diagnosis, in cases of splenic hypertrophy accompanied by marked pain with no contraindication opposing ablation. Although the type of surgical procedure applicable remains as executed by Viard, in 1851, the indications for ablation of the spleen have been considerably extended during more recent years. In an entire group included under the term "surgical affections of the spleen," splenectomy is beginning to be employed in certain cases of blood diseases and the hæmorrhagic diathesis. Ablation of the spleen constitutes in this respect the most recent advance in modern therapy and is often the only resource for saving the patient's life.

One of the rare affections of the spleen, recognized only with difficulty in two or three cases before the adoption of surgical treatment, consists of cyst. Neglecting cysts of parasitic origin, which are those most frequently encountered, we shall describe the process by which certain non-parasitic cysts of the spleen are formed. Until the present opinions have differed on this question. Now, however, they tend to agree, at least on certain points.

Splenic cysts may be of embryonic origin, as with dermoids; may be referable to an inclusion of the peritoneal endothelium within the spleen, with subsequent degeneration (Hamilton and Boyer); or depend upon polycystic degeneration (Coenen); or constitute lymphatic cysts. Next after congenital cysts come cysts due to circulatory disturbances producing thrombosis of small vessels with consequent necrosis of the splenic pulp, which produces most of the lesions occurring in the otherwise healthy spleen and *a fortiori*

most readily affects the diseased organ and gives rise to hæmorrhages. As the latter become encysted, they may produce hæmatic, serous or purulent cysts. Microscopically, such cysts present various appearances. Some are covered with epithelium or endothelium, which are unrecognizable in other cases. The structure may perhaps be that of pseudo-cysts. Spencer mentions a cystic teratoma of the splenic region.

The question of splenic cysts is allied to that of abscess-formation derived from cysts. Abscess, however, is most commonly caused by infarcts, emboli, etc.; for example, following endocarditis; or abscess may be metastatic in cases of paronychia, pyæmia, typhoid or recurrent fever, dysentery or articular rheumatism (Omi). Cysts of the spleen may be unilocular or multilocular. According to Hamilton and Boyer, they occur oftenest in women (65 per cent. of the cases).

With respect to the site of the cyst within the spleen, small lymphatic cysts are usually distributed discreetly, large lymphatic cysts are situated at the hilum (Subbotic) and blood cysts lie nearer the external surface of the spleen. It must be remembered also that cysts may be formed at the surface of the spleen at the site of chronic perisplenitis (*cystis hæmorrhagica vel serosa perisplenica*) or at the extremity of villosities arising from the same tissue (Subbotic).

It appears that the type of lesion has a decisive influence in the formation of a splenic cyst, principally in cases where the spleen is fragile originally. Spontaneous rupture of the spleen is rare. Anatomically, trauma may produce rupture of the spleen when the latter is hypertrophied, the capsule being torn although the trauma may not have penetrated to the interior of the pulp. Pulp extending beyond the borders of the wound forms small hernias (ruptures sèches or the Milzhernien of Schmaus). In cases of this kind, hæmorrhage is insignificant. The effused blood is resorbed or clots which may be formed are organized, all traces of the original lesions remaining only as cicatrices (Janusz). Another anatomical form of the causative lesion consists of splenic rupture extending deeply into the pulp concentrically toward the hilum. This lesion is perhaps caused by considerable escape of blood or by perforation of a softened infarct present in typhoid or recurrent fever, the accompanying complications being extremely grave.

Post-traumatic cysts appear to be larger than isolated cysts. In the literature, splenic cysts are discussed mainly by Coenen, who assigns them to cystic degeneration (polycystische Milzdegeneration). A section of the spleen thus shows a spongy formation containing liquid characteristic of hydrocele, together with fresh blood clots. Absence of complete data prevents a knowledge of the etiology of cyst-formation of this kind. The term employed by Coenen seems to imply that the author assigns such cysts to an organic cause.

Spontaneous rupture of the spleen may be due to engorgement of the stomach, adhesion of the capsule to the diaphragm, the spleen being torn during respiratory movements, or infarct (Janusz). Hæmorrhage of the

spleen may be violent, producing death in a short time. Hæmorrhage may also be periodic or delayed. In fact, there are cases in which one day, one and one-half days, four, nine and even fifteen days, elapsed between the traumatism and the effusion of blood (Kolb). In some cases, the lesion results in separating the capsule from the pulp, with formation of a subcapsular hæmatoma. Böttcher mentions a curious origin of splenic cyst, having found one presenting well-advanced amyloid degeneration. Following amyloid changes occurring in the wall of the main vessel, foci of necrosis are formed which become filled with liquid and which may later become covered with epithelium, but which for the moment are surrounded by a layer of connective tissue.

Cyst of the spleen was first noted by Andral, in 1829, in the course of an autopsy. Péan did the first ablation of a splenic cyst, in 1867.

With respect to the clinical conditions produced by splenic cysts, much pain is a common result. Cases in which such cysts are discovered at autopsy only, and without preceding clinical signs, are extremely rare. Cysts of the pancreas, liver, ovaries and kidneys, hydronephrosis and inflammations and tumors of these structures differ in origin. In no case has any splenic cyst been discovered before surgical intervention. Such cysts may cause a sensation of painful weight in the abdomen, respiratory disturbances, or disturbances of the stomach and colon (chronic colitis) due to pressure and permanent irritation, urinary or menstrual disturbances, or circulatory disturbances producing abdominal effusion and œdema of the legs owing to pressure on the inferior vena cava or left common iliac vein.

Splenic cysts may displace the spleen itself or cause torsion of its pedicle, may produce large adhesions with the anterior abdominal wall or diaphragm, or may cause modifications of the circulation. Such modifications occur in such a way that gigantic vessels of a collateral circulation are produced. Finally, the adhesions or the displacement of the spleen may produce the phenomena of acute or chronic occlusion. Among physical effects may be noted the friction which may be audible at a certain distance from the patient, as mentioned by Monnier. Fluctuation is rare. Blood examination usually shows nothing abnormal.

If we chronologically examine the various methods of treating cyst of the spleen, we remark that internal remedies were at first employed, and that finally treatment has consisted of radical ablation, now considered the only rational therapy. Development of our knowledge of the physiology and pathology of the spleen has permitted the application of bolder and bolder surgical procedures. Treatment of the affection thus consisted at first of the internal administration of iodine. Puncture was next tried. Still later, the cyst, after aspiration of its contents, was injected with a 3 per cent. solution of phenol (Mosler) or adhesion of a part of the cyst wall to the peritoneum was produced. Next, the cyst was opened extra-peritoneally; caustic potash was used to remove eschars of its envelopes (Récamier). Electropuncture was also employed (Magdelain). Simon introduced into the cyst a trocar

bearing an obturator, for aspirating the liquid of the cyst. When the serous surfaces were united, he incised the layers lying between the internal and external orifices. Volkmann applied laparotomy. Introducing phenolated gauze, he produced adhesions and incised the cyst seven to ten days later. Others, like Lindermann and Begin, opened the abdominal cavity and the cyst, suturing the borders of the cyst incision into the laparotomy wound. Some endeavored to ablate the cyst (cystectomy), resuturing the spleen afterward. At present, the only rational procedure applicable to splenic cyst, as with all conditions where operation is indicated, is splenectomy.

Following are the most important data of a personally observed case. The patient, a nun, aged thirty-eight years, had measles during childhood and typhus exanthematica at the age of fifteen. Her menses appeared at the age of fifteen. They were abundant, painful and continued for twelve days. Since that time, menstruation was regular, painful and more or less prolonged. For seven years, at intervals of a few weeks to a few months, the patient was subject to febrile attacks in which the temperature might reach 39° C., to chills, pain in the arms and legs, nausea and anorexia. These symptoms would continue for one to three weeks, would then cease, and would recur later. Three years ago the patient fell from a tree. The fall was followed by severe pain in the sacral and lumbar regions, especially on the left side. The pain prevented stooping forward, the patient remaining in bed for a week. At the end of this time the pain had diminished, though it was still present in the left lumbar region and left hypochondrium. Three months later, in the presence of chills and a temperature of 40° C., violent pain suddenly occurred in the lower part of the abdomen, in the region of the cæcum. Continuous nausea and vomiting, independent of eating, accompanied the other symptoms. These conditions continued for a month. A tumefaction, tender and painful to pressure, was then felt in the left hypochondrium. It was hard, increased in size, finally reached the size of a fist and changed its position according to the position assumed by the patient.

Since the patient entered hospital she complained of pain beneath the ribs on the left side and in the left lumbar region. The pain became more intense after physical effort. Appetite was wholly absent and the patient became extremely feeble. She had become considerably emaciated during the past two years, was persistently constipated, and had no urinary disturbances.

Examination showed no changes in the head or thorax. The abdomen was slightly distended. The left hypochondrium showed some fulness and was sensitive to palpation. McBurney's point was painful on pressure. The liver was not palpable. A tumor was palpable beneath the left ribs, extending to the navel. The surface of the tumor was smooth and elastic, becoming displaced when the patient changed position. The tumefaction in question corresponded to the spleen. The evening temperature was continuously subfebrile. Urinary examination was negative. Stool examination showed numerous ova of trichocephalus dispar and a few of ascaris lumbricoides. Blood examination showed nothing pathological. Since the spleen was found to be movable, the patient was removed from the medical to the surgical service.

Here two supplementary examinations were made, namely, cystoscopy and pneumoperitoneum. Cystoscopy showed slight congestion of the vesical mucosa, with no other changes. Indigo was eliminated intensely from both kidneys in five minutes. Pyelography showed no changes in the contour of the renal pelvis and ureter. The palpable tumor appeared to have no connection with the kidneys. After instituting a pneumoperitoneum, by introducing 100 cubic centimetres of oxygen into the peritoneal cavity, it was noted that the spleen was considerably enlarged. It had become spherical, was displaced during deep inspiration and could be easily impelled toward the pelvis. The röntgen examination similarly showed a mobile spleen.

A substance of great value for preserving the spleen and therefore for the differential diagnosis of affections of this kind consists of adrenalin, which readily attacks the spleen. In our case, injection of one milligram of adrenalin produced no change in the splenic figure. Basing his opinion upon abundant clinical material referring to preservation of the size of the spleen by the ingestion of adrenalin, Stefek formulates the following conclusions:

1. Maximal diminution in the size of the spleen following an injection of adrenalin occurs fifteen to twenty minutes after the injection.

2. In neoplastic or fibrous changes, as in lymphogranuloma, for example, the contractility of the spleen is limited to the unaffected portion of the splenic pulp.

FIG. 1.

FIG. 2.

3. Since the limits of the tumor in the left hypochondrium did not change after injecting adrenalin, blood examination may indicate whether the tumor in question is the spleen, as modified by the disease-process present, or whether it originates from a neighboring structure.

After diagnosticating mobile spleen, operation was undertaken. The splanchnic nerves of the left side were anæsthetized by the Roussel method, the seventh, eighth, ninth and tenth intercostal nerves were rendered insensitive, transverse incision was made through the rectus muscle and the abdomen was opened. It was noted that the spleen was pyriform and that its upper pole was of regular structure, while the lower pole was altered, swollen, of the size of two fists, without adhesion to neighboring parts, the lower parts of the tumor bearing enlarged venous vessels. After ligating the vessels as usual, the spleen was ablated, the wall being sutured in three planes.

The organ thus removed at operation was pear-shaped, measuring 25 by 13 centimetres, the widest antero-posterior diameter being of 14 centimetres (Fig. 1). The

upper extremity presented the structure of normal spleen and was 11 centimetres long and 5 centimetres wide. Well-marked cicatrices were present in the lower extremity and thickened areas in the capsule appeared as extensive spots connected by folds. Distinct fluctuation was present on the anterior surface of the lower extremity. Puncture yielded 140 cubic centimetres of an amber liquid, transparent, and coagulating in a test-tube.

The section (Fig. 2) revealed large cysts not inter-communicating, filled with amber liquid and clots, and having smooth and slippery walls. Section of the upper extremity showed the normal splenic structure. Bacteriological examination of the liquid of the cysts showed that it was perfectly sterile. Microscopic examination of tissue taken from the upper extremity likewise showed normal structure.

Tissue taken from the pulp lying between the cysts and from the cyst walls showed the following conditions: Certain preparations presented a perfectly homogeneous necrotic mass; at other sites, this mass was beginning to soften; the pale structure of splenic tissue occurred at various sites. Amid the necrosed masses, fibrin existed rather abundantly. In parts of the spleen near the necrosed masses, there were a few blood-vessels whose walls were distinctly thickened. Thickening was especially marked in the vascular endothelium, notably diminishing the lumen of the vessel and even obliterating the lumina of small vessels.

The entire microscopic image showed circumscribed necrosis appearing in consequence of obstruction of the large vessels by obliterative endarteritis. A hæmatoma might have been considered present, were not the contrary indicated to some extent by the absence of hæmosiderin. Following operation, the patient's condition was excellent and she left hospital thirteen days after it. During eight days only, she experienced severe pain in the lower intercostal spaces on the left side and twinges in the cardiac region. The pain may be attributed to the Roussel method of anæsthetizing the intercostal and splanchnic nerves. We have noted the same thing in other cases where this method of anæsthesia was employed. The temperature remained within subfebrile limits continuously after operation.

Comparing the data obtained from our findings and supplementary examinations with those shown by the microscopic examination, we may conclude that an infarct or embolus was produced by a factor which cannot be exactly defined. The primary existence of emboli in the smaller splenic vessels explains beyond question the formation of the multilocular cysts. Since the circulation had diminished or disappeared in certain parts of the spleen, areas of necrosis or perforation of softened infarcts had been produced, as mentioned by Chwostowski, for example, with reference to a case of typhoid, and also as mentioned by Stcherbakov in connection with a case of recurrent typhus. As soon as the local blood-supply becomes increased, the spleen becomes momentarily enlarged or symptoms of congestion begin to manifest themselves, and not only may laceration of the pulp occur, but also of the capsule. It goes without saying that traumatism still further facilitates laceration of the splenic pulp, under the given conditions. In our case, a lesion was shown distinctly by the findings, the patient herself perceiving a tumor in the left hypochondrium. In a parallel way, acute phenomena of inflammation occurred, accompanied by chills and high temperature. Phenomena which were clearly peritoneal then ensued, explicable either by infection of the spleen or torsion of its pedicle. The appearance of several cysts evidently increased the size of the mobile spleen and aggravated the various com-

plications which may arise from a spleen of this kind. Increase in the size of the lower extremity mechanically created conditions favoring distention of the ligaments and pedicle and the production of a mobile spleen. The splenic mobility was diagnosticated when operation was decided upon.

Of the supplementary tests, the pneumoperitoneum possibly supplied the most exact picture of the size, form and mobility of the spleen. In our opinion, pneumoperitoneum may prove more useful than any other method of examination in difficult cases. The adrenalin test of Frey is also very important in cases where the spleen has lost its normal contractility because of neoplastic or fibroplastic modifications.

Very characteristically, after ablation of the spleen the menstruation of our patient, previously painful, abundant and prolonged for twelve days at each epoch, became normal after a period of two months and has continued normal thus far. The symptoms cannot be attributed to pressure of the enlarged spleen upon the genital organs, since the abnormal menstruation had existed since the patient's youth. Ablation of the spleen abolished an abnormal condition. Perhaps the writers are correct who recommend irradiation of the spleen with the X-rays in cases of gynecologic hæmorrhage (Nürnberger), for, by lowering the functional capacity of the spleen radiant treatment provides a sort of temporary and partial splenectomy. Subbotic points out in his work a certain correlation existing between the spleen and the menses. He states that, in a case of mobile spleen, malarial splenomegaly was followed by an arrest of menstruation, continuing for two months. After ablation of the spleen, menstruation returned in twenty-four days.

Diagnosis is exceedingly important in cases of splenic cyst, for spontaneous cure cannot be counted upon. Apart from the subjective pain afflicting the patient, as well as from displacement of neighboring organs and symptoms of compression, spontaneous or secondary rupture of the spleen may occur, with hæmorrhage. We believe that splenic cyst may also be followed by splenic abscess, for the presence of a cyst constitutes marked modification of normal conditions and creates a site of lowered resistance.

With respect to complications supervening during operation, we may remark that grave hæmorrhage may occur if existing adhesions are large. Again, the collateral circulation may be considerably greater than the normal circulation and, under these conditions, hæmorrhge may occur when the splen'c pulp is incised or laceration may occur during the intra-abdominal manipulations, and arrest of the ensuing hæmorrhage may be very difficult. Jonnesco therefore advises that, in detaching the spleen from adhesions, incisions be made in the direction of the abdominal walls and not in the direction of the spleen. Among other possible complications may be included opening of the pleura. This is not dangerous, on condition that the diaphragm be immediately sutured. If the cysts are very large, care must be observed that the intra-abdominal pressure be permitted to diminish slowly, in order to avoid sudden irritation of the solar plexus, a result which would prove immediately fatal (Adelmann).

In certain cases, unduly extensive adhesions and the difficulty of orienting the parts may permit diagnostic errors even after opening of the abdominal cavity. In such cases, it is impossible to know whether the cyst arises from the liver, pancreas, kidney, mesentery or spleen. Herfarth thus relates that a cyst supposedly hepatic was recognized in the course of a laparotomy. It was sutured into the wall, and a permanent fistula made, but, after seven months, a fresh laparotomy showed that the cyst was of the spleen, being merely united with the liver by a long tract of adhesions. On learning the real nature of the cyst, the spleen was ablated. Some writers recall the fact that incrustations of calcium salts may be deposited upon cyst walls (Jonnesco).

With respect to the incision employed for splenectomy done in the treatment of cyst of the spleen, any operation of this kind should be performed by means of lateral laparotomy and a para-rectal incision or by means of an oblique or transverse section of the rectus abdominis muscle. Coenen reached the spleen through long, oblique incisions beginning in the left hypochondrium and extending to the vesical region. The patient's position for this purpose was that used for nephrectomy. Mayer removed the spleen from behind, the incision resembling that employed in nephrotomy. In this way he obtained very easy drainage of the secretion toward the back. Others have employed, with the same object, a supplementary incision beginning behind. It may be taken as a general rule that the incision should be sufficiently extensive if the spleen is large and imbedded in adhesions, in order that the entire operative procedure may be in full view. Access to the spleen is thus very important in relation to the abdominal wall. Destruction of the nerve-supply of the wall is followed by formation of a large post-operative hernia. The latter entails a variety of dangers and often obliges the surgeon to proceed to grave and complicated operations. If the spleen is to be approached by the abdominal route, many incisions are available (Ruggi, Kehr, Marion, Sprengl, Lejars, Lecène and Deniker, and Leotta). The incision of Papayoannou, which we mention lastly, especially appeals to us since it respects the nerve-supply of the abdominal wall and gives ready access when the spleen is hypertrophied, permitting adequate view of the entire operation, as we have had occasion to verify during our surgical experience. This incision, in fact, has enabled us to ablate spleens considerably enlarged and accompanied by extensive adhesions.

Since diagnosis is very difficult in certain affections of the spleen, various writers have been for a long time of the opinion that the diagnosis should be based upon material obtained from the spleen. The simplest way of obtaining such material is by means of an exploratory puncture, a procedure recommended by a few writers (Proppuig) but one condemned by most authorities. Although splenic puncture is very dangerous in certain affections of the spleen in which the organ is very tender or in which it may be purulent, and although it is practicable only if operation can be done immediately, it is nevertheless necessary to point out the fact that Rencki has

several times employed splenic puncture to obtain histological and bacteriological data, and without ever encountering unfortunate results or symptoms. For splenic puncture, a hermetically tight Record syringe is required, capable of containing ten grams and provided with a needle one millimetre in diameter. The spleen is immobilized and the patient is requested to suspend respiratory movements. Aspiration is performed very slowly. If necessary, the needle is inserted more deeply. Rencki employs the same needle for introducing one-quarter to one-half milligram of adrenalin and, when the splenic pulp begins to contract, he injects two cubic centimetres of a coagulant as the needle is slowly withdrawn. After applying a bandage and pressure for some time at the site of puncture, an icebag is placed on it for three to four hours, the patient remaining meanwhile at absolute rest. By this method Rencki has diagnosticated Gaucher's disease, among other affections.

Among other methods of surgical diagnosis, exploratory incision must be mentioned, as described by Stubenrauch. He applies local anæsthesia in the axillary line, lays bare the splenic surface by means of an incision eight centimetres long, and performs puncture. In Stubenrauch's case, however, blood continued to ooze after withdrawal of the cannula and the pulp was lacerated afterward. Since suturing failed to arrest the hæmorrhage, the spleen was ablated. This case clearly shows the danger of splenic puncture even when all details of the operation are in full view of the surgeon.

Prognosis should be considered very important in cysts of the spleen, for the cysts may be lacerated or undergo inflammatory changes at any time. Since large splenic cysts elongate the pedicle of the spleen as a general rule, the pedicle may readily undergo torsion and the various consequences of this effect may ensue. If the patient experiences sudden pain, the surgeon must be especially watchful, since the pain may be due to compression or displacement of the organ, to its sudden increase in size, or to laceration of the splenic pulp occurring beneath or with the capsule.

In connection with the formation of cysts of the spleen and the subsequent arrest of its normal function, compensative hypertrophy of the spleen may occur, as reported by Hamilton and Boyer.

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IMPERFORATE ANUS

A METHOD OF DETERMINING THE SURGICAL APPROACH

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Atresia of the anal canal or the lower portion of the rectum occurs about once in every 5,000 births (Tuttle[1]). It would appear to be about equally divided between the sexes. Not infrequently it is associated with other embryologic defects. Structures which have a common development from the urogenital sinus are most likely to exhibit embryologic defects in association with imperforate anus.

Clinical Picture.—Casual inspection of the perineum in the newborn will usually detect the presence of imperforate anus. When the anal opening is normal the recognition of the existence of this anomaly is usually made with subsequent failure of the child to expel meconium. Examination with bougies then will reveal the fact that an interruption of the continuity of the bowel is present. A child with an imperforate anus usually takes his feedings in the usual manner for the first twenty-four hours before regurgitation commences. The abdomen only gradually distends. In those instances where an internal fistulous communication exists with either the bladder, urethra, or vagina the condition may go unrecognized for a longer period of time. When communication exists between the urethra and the rectum, the voided urine will occasionally be tinged with fæcal material; when communication with the bladder exists, constant admixture of fæces with the urine is the rule.

Treatment.—Early establishment of communication with the exterior is necessary in complete atresia of the anal canal or rectum. In the female when communication with the vagina exists, no indication for immediate operative intervention is ordinarily necessary. In such cases the operation may well be deferred until a later period when the transference of the lower bowel between the fibres of the external sphincter of the anal canal can be made with greater safety and more precision. When internal fistulous communication with the urinary passages exists operation is usually necessary to divert the fæcal stream because of danger of urinary infection. That instances of this sort may reach mature age despite the persistence of such an abnormal communication is demonstrated from time to time. In those instances in which a diaphragm-like septum is present, a simple slit of the anal skin and probing of the wound and dilatation with a hæmostat is all that is necessary. Subsequent occasional dilatation with bougies may be required. In those instances where the lower portion of the rectum as well as the anal canal is atresic the operative approach is frequently difficult and uncertain.

To date no satisfactory method has been devised to determine whether the atresic bowel may be reached from below or not. In the majority of instances the rectum even when atresic does descend well into the pelvis and should be capable of being reached from the perineal approach. Occasionally, however, the rectum remains extra-pelvic and is not accessible from beneath.

Brenner [2] has emphasized the fact that abnormal narrowing of the inter-ischial tuberosity measurement is indicative of the presence of a rectum that may be extra-pelvic. The accompanying figures (1 and 2) [from Keith [3]] indicate the location of atresia in specimens of imperforate anus observed by Sir Arthur Keith in London pathological museums and hospitals.

In this brief communication we should like to direct attention to a method by which one may accurately ascertain to what level the rectum reaches in

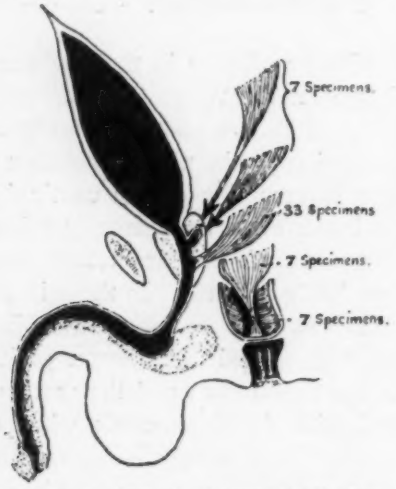

FIG. 1.—The site of atresia in fifty-four specimens of imperforate anus in males examined by Sir Arthur Keith. The specimens in which communication was established with the bladder and urethra are also indicated.

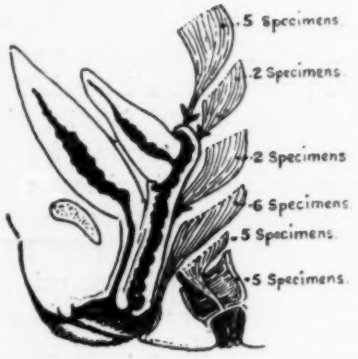

FIG. 2.—The site of atresia in twenty-five specimens of imperforate anus in females examined by Sir Arthur Keith. The specimens in which communication was established with the vagina are also indicated.

the pelvic cavity. If the child is held upside down in the inverted position by the lower extremities the gas in the rectum will rise to the top and indicate the distance intervening between the rectal wall and the skin of the anal dimple when a flat X-ray film is made. We have recently had an opportunity to evaluate the importance of this method in two cases in determining pre-operatively the accessibility of the occluded bowel from the perineum. Even though the rectum is anatomically accessible from beneath in the majority of instances, the corroboration of such definite evidence as the accompanying illustrations afford of the actual level to which the rectum attains lends encouragement and assurance to the surgeon that persistence will reward his efforts when a tedious and seemingly inaccessible approach from beneath prompts him to open the abdomen and perform a colostomy.

The atresic bowel should be approached from the perineum when possible for statistics indicate that the mortality of this procedure is attended with

a risk of about 25 per cent. in which the approach is difficult, whereas when laparotomy and colostomy is done this mortality is more than doubled. When a communication with the bladder or urethra exists an attempt should be made when a proctoplasty is done to divide and close the abnormal opening. Should such an effort prove unsuccessful a complete deviation of the fæcal current by a colostomy of the permanent type in the left inguinal region may later become necessary to obviate the occurrence of urinary infection.

In those instances in which the rectum is not immediately accessible by

FIG. 3.—Film made of abdomen of Case I in upright position. The gas in the bowel rises in the abdomen.

FIG. 4.—Film made of abdomen of Case I in the inverted posture with imperforate anus. The gaseous outline of the rectum goes practically to the anal dimple and is easily made out. There is also considerable intestinal distention present.

simple puncture through the perineum, dissection should be made as near the sacrum as possible to obviate injury to the urethra.

The external sphincter of the rectum is normally developed in all cases of atresia of the anal canal or rectum. This sphincter develops in connection with the perineum and not with the bowel. Hence, if the proctodæum be present, the surgeon may rely on obtaining an orifice provided with competent sphincters.

A brief summary of the two cases in which the method described above was employed is appended.

CASE I.—Hospital No. 49852. Male child, two days old. Admitted to the University Hospital September 8, 1929, two days after birth. The child was accompanied

by a friendly neighbor who was unable to give any history except that the child had had no bowel movements and had commenced vomiting on the day previous to his admission. As far as could be ascertained both parents were in good health.

Physical examination revealed an otherwise well-developed child apparently in some distress from abdominal distention. The chest and heart are negative; the abdomen is distended and tympanitic; the abdominal muscles are slightly tense, but there is no muscle spasm; the liver and spleen are palpable. No peristaltic waves are visible. Perineum: the diaper was found to be moist with urine but not stained with meconium. The anus was found to be imperforate. There is slight bulging at the anal region and a greenish discoloration at the anal dimple is visible. Physical examination otherwise is negative. Examination of blood and urine is normal. Temperature 97.6°.

X-ray examination with the child inverted reveals the presence of considerable gas

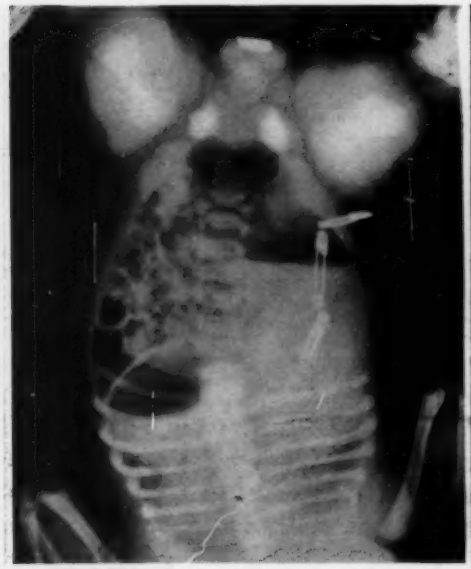

FIG. 5.—Film made of the abdomen of Case II in the inverted posture. The terminal end of the rectum appears to be far removed from the metal disk placed over the anal dimple. There is also considerable intestinal distension present.

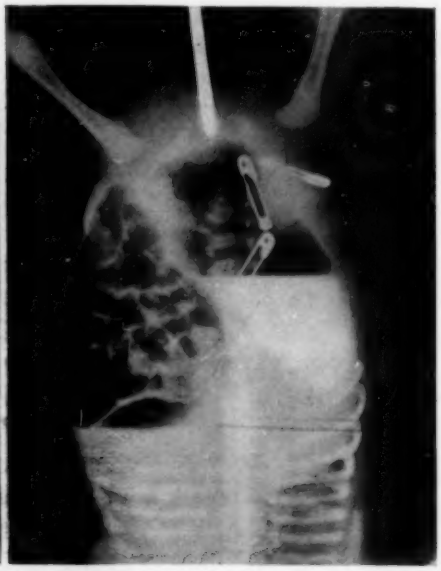

FIG. 6.—Plate made also in the inverted posture ten hours later, at which time slight pressure was made over the anal dimple with a clinical thermometer. The feasibility of a surgical approach from beneath is well indicated by this picture.

in the intestinal loops and the rectum is observed to extend as a cone-like projection almost to the skin margin.

The patient was operated upon immediately after the X-rays were made. The anal dimple was probed without anæsthesia and greenish meconium came away; with the aid of a small Halsted hæmostat the opening was dilated by spreading the forceps. The post-operative convalescence was very satisfactory and the child was discharged in good health on September 11, 1929.

CASE II.—Hospital No. 50121. Male child, admitted September 29, 1929, fourteen hours after his birth at Osakis, Minnesota. The imperforate anus was discovered at birth by the family physician (Dr. A. J. Gullickson). The child was in very good condition and had not vomited. The mother and father were normal and in good health. Physical examination revealed an otherwise apparently well-developed child. No abnormal findings in chest and heart are made out. The abdomen is not distended and peristaltic waves are not visible. Liver and spleen are not palpable. The diaper is moist with urine but not stained with meconium. No bowel is palpated through the

perineum by pressure upon the abdomen. There is no discoloration at the anal site. Examination is otherwise negative. Blood and urine are essentially normal.

X-ray examination with the child in the inverted position shows intestinal distension not appreciable on visual inspection of the abdomen; the distal loop of bowel filled with gas extends to just below the pelvic brim. At an examination made ten hours later the anal dimple was gently pressed upon with a clinical thermometer which demonstrated that the rectum could be reached from below. The patient was operated upon twenty-eight hours after birth and the rectum brought down and sutured to the skin margins. Some difficulty was encountered in finding the lower end of the atresic bowel.

The post-operative convalescence was very satisfactory until the sixth post-operative day (October 7, 1929). The child then developed attacks of dyspnœa and cyanosis. X-ray examination of the chest showed beginning pneumonia. On October 9, the patient again became very dyspnœic and cyanotic. Oxygen was given but the patient died at 9:55 A.M.

Post-mortem examination revealed an extensive bilateral pneumonia, an atresia of the aorta, a patent foramen ovale and a patent interventricular septum. There were no other abnormalities of the gastro-intestinal or genito-urinary tract. The patient had made a satisfactory convalescence and death from pneumonia and congenital heart defects was unrelated to the operation.

CONCLUSION

The employment of the flat X-ray film of the abdomen with the infant held in the inverted posture serves as a reliable method of determining the surgical approach in imperforate anus.

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PRIMARY CLOSURE IN PROSTATECTOMY

By Thomas E. Gibson, M.D.,
of San Francisco, Cal.

Adequate drainage with secondary healing of prostatectomy wounds, as opposed to primary closure and healing, is a surgical tradition which so thoroughly dominates the modern surgeon's mind that any departure therefrom is apt to be regarded as rank heresy. This ancient teaching rests primarily on the very estimable fact that in the past no more adequate control of hæmorrhage was known than the use of gauze packs or rubber bags to exert pressure against the bleeding surfaces. Drainage and secondary healing were therefore necessary corollaries. Moreover, as most prostatectomy wounds were apt to be more or less infected, drainage and secondary healing were considered a necessary evil in conformity with the old fetish which taught that surgical wounds involving the urinary tract must of necessity drain urine for a while before healing. In other words, a temporary urinary fistula must of necessity be the price of any incision involving the urinary tract.

It is my purpose to demonstrate in this presentation without being iconoclastic and without offending the fundamental principles of sound surgery, that primary closure and healing are applicable at least to perineal prostatectomy wounds, and can be made the rule rather than the exception.

It is aside from the main theme to discuss in this paper the relative merits of suprapubic *versus* perineal prostatectomy. The reader is referred to Hinman's recent comprehensive treatise [1] on perineal prostatectomy. Having been trained in the latter procedure, it has my personal preference in the vast majority of cases. The perineal operation is probably a more benign operation, a conclusion which is supported by the recent work of Goldstein and Abeshouse.[2] However, the suprapubic operation is in more general favor because it is technically easier for the self-made urologist, and probably the ultimate results are not radically different in either method. The only opportunity for the perineal operation to gain more general favor is by the production of results noticeably superior to those which can be obtained by the suprapubic approach. This it has a chance to do because of the relatively greater adaptability of primary closure to the perineal operation.

Both the suprapubic and perineal operations of prostatectomy have become fairly well standardized, yet they share one fault in common, and that is our present crude methods of dealing with hæmorrhage at the time of operation. As a former assistant to Dr. Frank Hinman, it used to be my painful duty to remove the packs after twenty-four hours in the days when he was routinely packing all his perineal cases. The conclusion was finally reached that whether one uses gauze packs or distensible rubber bags they both offer the following objections:

1. They stretch open still farther the dilated prostatic cavity, which under

ideal conditions should be permitted to collapse and shrink as soon as the gland is removed.

2. They cause the patient discomfort, not only by their presence but by their removal as well. Patients who have been prostatectomized look upon this as the most unpleasant feature of the treatment of prostatic obstruction.

3. They delay wound healing by leaving behind them a temporary urinary fistula on their withdrawal, which requires ordinarily from two to four weeks to close, and sometimes even longer.

Packing is not an ideal way of controlling hæmorrhage in any operation,

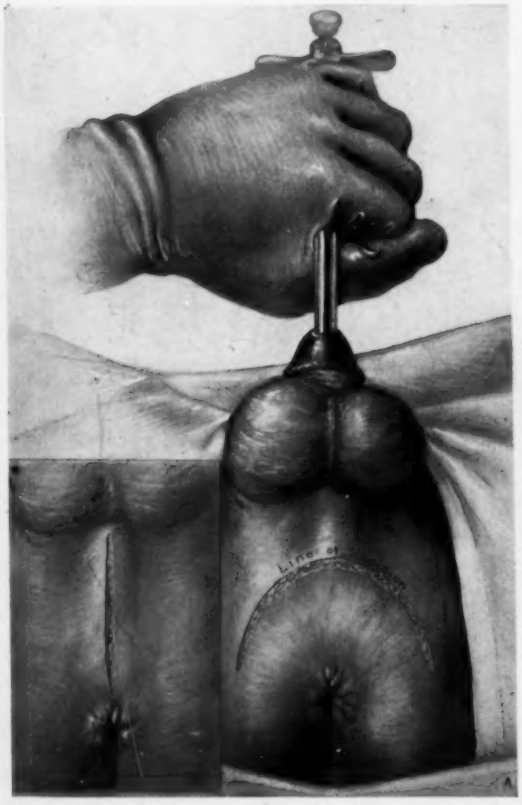

FIG. 1.—Drawing illustrating types of incisions used in perineal prostatectomy. The transverse semilunar incision (A) is most suitable for the operation here described. Note the Crowell tractor which has been passed through the urethra into the bladder.

FIG. 2.—The second step in the operation, following the primary incision through the skin, is here illustrated, namely, the penetration of ischiorectal fossæ on either side of the central tendon posterior to the transversus perineal superficialis muscles. The point of penetration is on a line joining the ischial tuberosities. The index finger enters easily by blunt dissection until the apex and posterior surface of the prostate is felt.

and least of all in prostatectomy where urinary drainage acts as a deterrent to wound healing. In general surgical operations packing is always a last resort when other methods fail to control hæmorrhage, and this should be true in prostatectomy also.

This line of reasoning seemed more theoretical than practical to me at first, as perhaps my original publication [3] may have seemed to some who may have read it. I judge that in general the reaction to this idea has been much as my own reaction was to the paper by Lower,[4] in which he advocated

primary closure in suprapubic prostatectomy. In the discussions which followed, his procedure was rather severely criticized by Chute, Bransford-Lewis, Randall and others. I shall not enter into the reasons against primary closure in suprapubic prostatectomy, but those surgeons to whom they are not obvious will find them well enumerated in Randall's discussion of Lower's

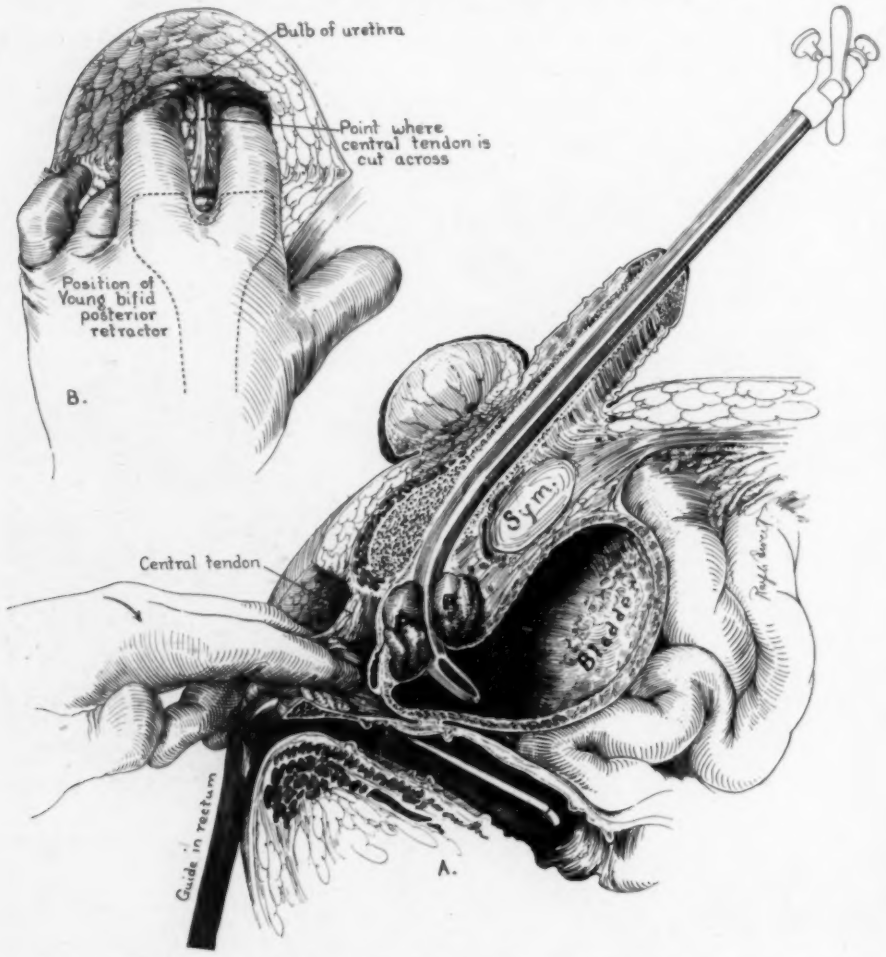

FIG. 3.—The third step in the operation is the division of the central tendon back of the bulb and transversus muscles (B). During this procedure the rectum is retracted posteriorly with either the Young bifid retractor or two fingers of the left hand. (A) is a lateral view of the perineal structures and their relations. The central tendon has been placed under tension preparatory to its division. Note the Crowell tractor passing through the urethra into the bladder with its blades opened and forcing the prostate down toward the wound, the symphysis pubis acting as a fulcrum. Note, also, the instrument in the rectum serving as a constant guide to its location.

paper.* In the perineum, however, conditions are entirely different and the arguments against primary closure do not hold here. Before primary closure can be safely done, one must first be certain that all bleeding has been care-

* Recently S. H. Harris in an article entitled "Suprapubic Prostatectomy with Closure" (Surg., Gyn. and Obs., vol. 1, January, 1930, pp. 251-260) reported in detail a method of primary closure in suprapubic cases which has proved very successful in his line.

fully controlled. My procedure has been to swab out the prostatic cavity with warm 10 per cent Monsell's Solution or a mixture of one dram of tannic acid to an ounce of adrenalin, and then, if necessary, apply mattress sutures approximating the lip of vesical mucosa around the bladder neck to the prostatic capsule. This not only checks bleeding around the bladder neck where post-operative hæmorrhage is most apt to occur, but also obliterates the prostatic cavity. Doctor Young depends on sutures entirely. If bleeding can be satisfactorily controlled in this manner the wound is closed tight with-

FIG. 4.—Photograph of the rectal guide. This may be inserted in the rectum at the beginning of the operation or at any subsequent stage should there be doubt as to the exact position of the rectum. Such a device is positive insurance against rectal injury, which is the main bugbear of the perineal operation.

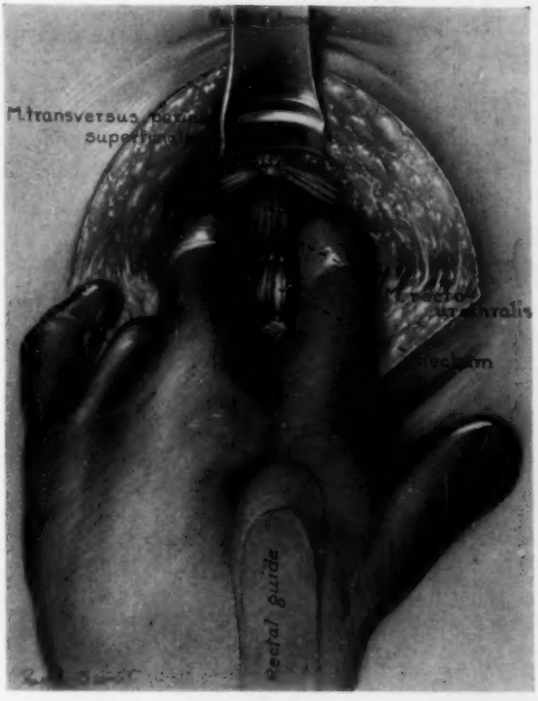

FIG. 5.—The crucial step in the operation is the manner of dealing with the recto-urethralis muscle following division of the central tendon. This muscle is not a definitely demarcated structure, but represents merely certain fibres of the longitudinal muscle layer of the rectum which insert in the region of the apex of the prostate and hold the rectum in close apposition to the posterior aspect. In the illustration a dotted line shows where the recto-urethralis is split near its insertion while two fingers of the left hand hold the rectum down out of harm's way. The recto-urethralis is placed on tension by retracting the urethral bulb anteriorly. In some cases it is easier at this stage to approach the prostate laterally, pushing the recto-urethralis muscle to one side.

out drainage, the urinary stream being taken care of by means of a retention catheter through the urethra, attached to a Connell suction apparatus.

If bleeding cannot be checked satisfactorily by suture then the prostatic fossa is packed with gauze strips (see illustrations). In general, it is easier to take sutures in the bladder neck after perineal prostatectomy than one might at first think. Doctor Young uses a boomerang needle for this purpose. To facilitate this step in the operation in difficult cases I have had a

special suture carrier constructed (Fig. 10), but ordinary needles and needle-holders are usually applicable.

In perineal prostatectomy it is generally possible to get an adequate view of the bladder neck, and I venture to say that with a little practice one can close the majority of cases without using either packs or bags. This should not lengthen the operating time more than five or ten minutes at most. In a consecutive series of 20 perineal prostatectomies (see Table I) I have been able to do a primary closure successfully in 13. In the other 7 I felt compelled to resort to packs to completely check the bleeding, thus making primary closure and primary healing impossible. Analyzing the two groups

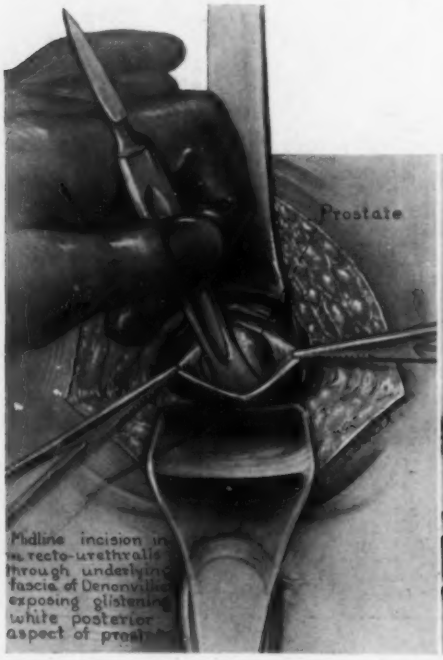

Fig. 6

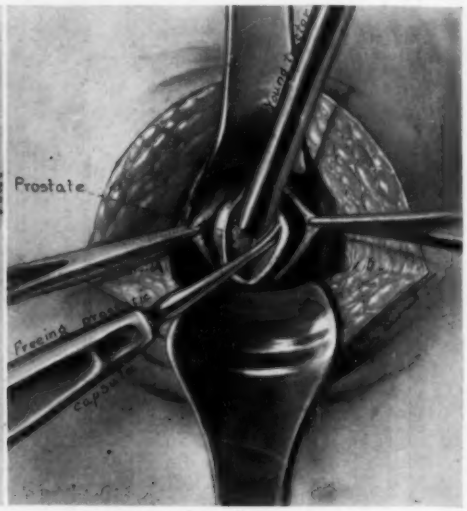

Fig. 7

Fig. 6.—The margins of the mid-line slit in the recto-urethralis are grasped with Allis forceps and a knife handle slipped down over the posterior surface of the prostate between the layers of Denonvillier's fascia, which covers the posterior aspect of the prostate gland. The smooth, glistening, greyish-white surface of the prostate is now visible.

Fig. 7.—A mid-line incision is made in the prostate onto the instrument in the urethra. This incision is extended toward the base of the prostate and does not approach too closely the apex where lies the external vesical sphincter. The plane of cleavage between capsule and prostate is now revealed and enucleation is begun with the Kocher dissector. If it is considered expedient the Crowell tractor is removed and replaced by the short Young prostatic tractor, which is passed through the wound into the bladder and its blades opened so as to aid in the enucleation by bringing the prostate into the wound.

of cases with respect to duration of post-operative convalescence, the average time sent in the hospital by those in whom packs were used was twenty-two days. In the cases of primary closure in which packs were not used the average time spent in the hospital after operation was sixteen days. This figure would be even smaller were it not for the fact that 3 cases developed epididymitis, and in 2 the primary closure broke down and drained temporarily. One patient went home on the eleventh day post-operative, while

a number were discharged by the fourteenth day. Although this is a small series to report, I have been able to show to my own satisfaction with a more extended experience that this method will save patients on an average of a week or more in the hospital, not to mention the saving of dressings and of personal discomfort to patients occasioned by the removing of packs or bags after operation. The perineum is notoriously resistant to infection but even so, the remarkable lack of local or general reaction, and redness or swelling in the wound has exceeded my fondest expectations.

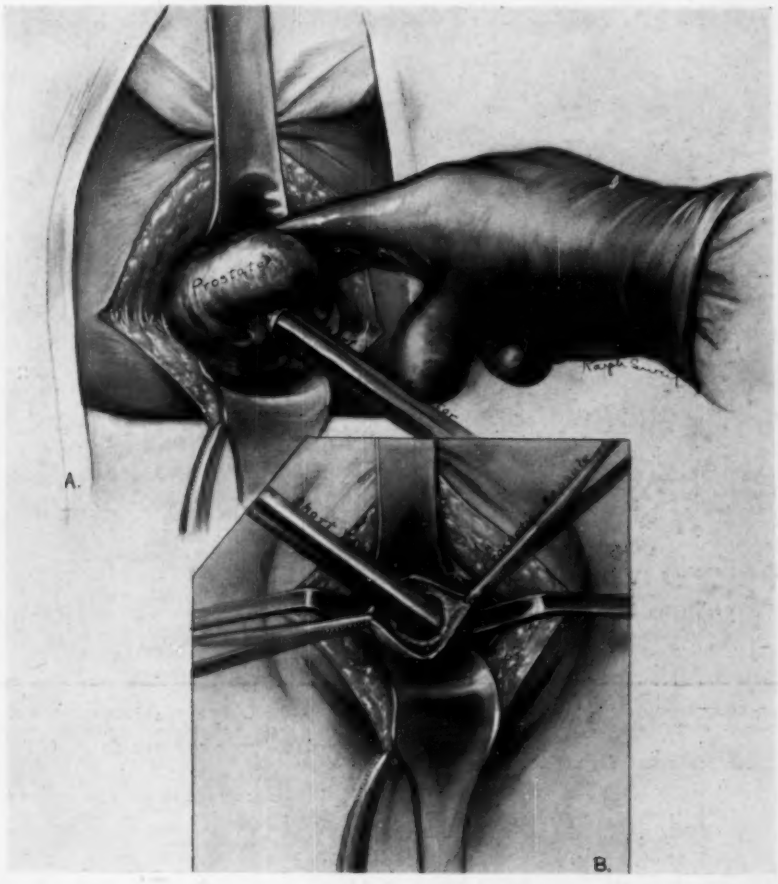

FIG. 8.—Completion of the enucleation of the prostate (A). The prostate is shelled out either en masse or piecemeal with the index finger sometimes aided by curved scissors, care being taken not to tear the incision in the prostatic capsule. Following enucleation the prostatic fossa can be visualized (B) and measures instituted to control bleeding as outlined in the text.

I felt at the time of publication of my original article on primary closure that I was responsible for an innovation which marked a distinct advance in the field of prostatic surgery. Later I found that I must share priority with Dr. Hugh Young, of Baltimore, since he had published in the same year (1928) in *Nelson's Loose Leaf Living Surgery* a method which he called "Complete Plastic Closure of the Prostatic Wound" which was identical in almost every detail with my own procedure. Doctor Young stated that he

had carried out primary closure in about 100 cases. He stated further that the results were very satisfactory, and in 60 per cent of the cases there has been no leakage through the perineum and apparently *per primam* healing of the capsular closure. He further stated that time alone will tell whether plastic closure with catheter drainage through the urethra is as safe an operation as free perineal drainage. His conclusion was that it gave a speedier convalescence. This procedure is probably not applicable to all

FIG. 9.—Drawing showing catheter (2 hole Eynard 26 F.) passed through urethra to bladder, prior to closure of prostatic capsule, for permanent drainage.

FIG. 10.—Drawing to illustrate methods of suturing bladder neck and prostatic capsule to control bleeding and obliterate prostatic fossa, (A) in case the mid-line incision is made through the prostatic capsule; (B) in case the inverted V type incision is used. Variations are made in these sutures to suit the individual case.

TABLE I

Primary Closure	Time in Hospital Post-operative	Complications
—	21 days	
—	14 days	
X	14 days	
—	21 days	
X	12 days	
—	25 days	
X	21 days	Epididymitis
—	26 days	
X	14 days	
X	28 days	Epididymitis

TABLE I—*Continued*

Primary Closure	Time in Hospital Post-Operative	Complications
×	24 days	Epididymitis Wound opened
×	13 days	
×	14 days	Cancer
×	13 days	
×	14 days	
×	Died*	
×	20 days	Wound opened
—	22 days	
×	11 days	
—	26 days	Epididymitis

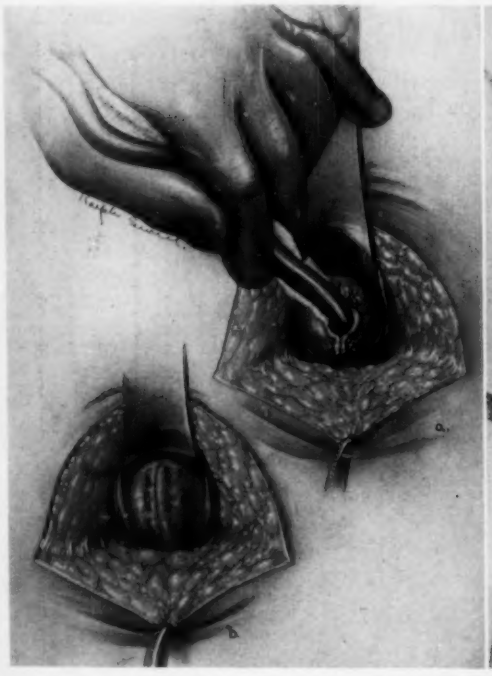

FIG. 11.—In some cases sutures including the lip of mucosa at the bladder neck are not necessary so that the prostatic capsule is closed with mattress sutures of No. 2 chromicized gut as in (b). In cases where packing must be resorted to, a catheter is passed through the urethra (Fig. 12) and a gauze strip is packed in the prostatic fossa around them (a). A retroprostatic pack may also be used if necessary.

FIG. 12.—Drainage is provided via the natural channel by means of a F. 26 catheter passed through the urethra into the bladder. A second catheter through the wound to the bladder is used only in those cases where it is necessary to resort to packing to control hæmorrhage.

Twenty Cases. Packs used in 7. Average stay in hospital, 22 days post-operative. Primary closure 13. Average stay in hospital, 16 days post-operative. Two of 13 cases of primary closure opened and drained.

* This patient on hospital entry had complete retention of urine and was in uræmia, with blood urea 237.5 milligrams per 100 cubic centimetre and creatinine 7.5 milligrams per 100 cubic centimetre. Phthalein output for two hours—0. After two months on retention catheter, etc., blood chemistry was normal, but he still constituted a practically hopeless surgical risk.

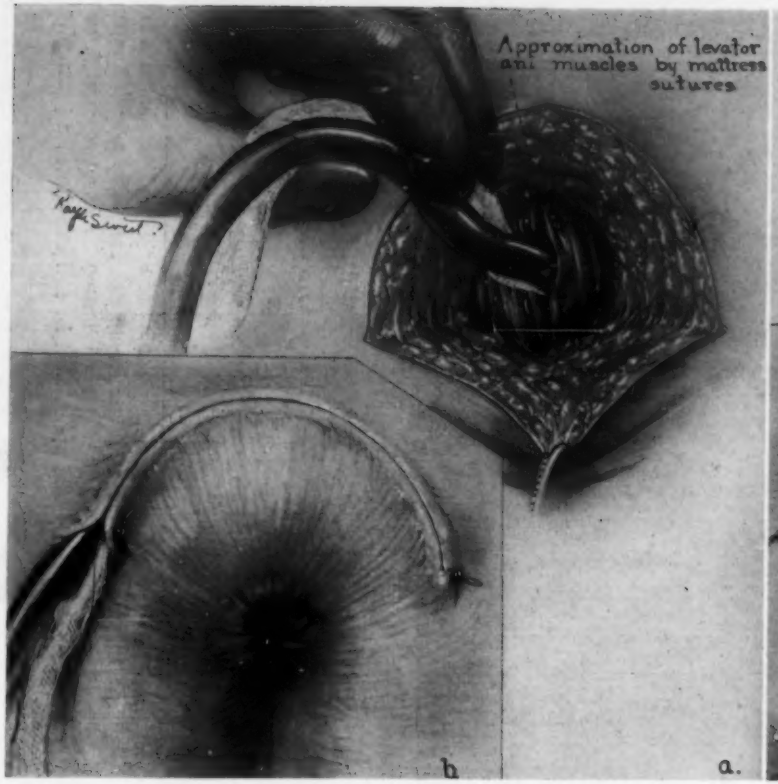

FIG. 13.—Completion of wound closure, consisting in approximation of perineal musculature with mattress sutures of No. 2 chromicized gut. When bleeding has been controlled without the use of gauze packing the perineal catheter is also dispensed with, and the perineal wound closed tight without drainage of any sort. All drainage is then via the retention catheter in the urethra, which is removed usually within six to nine days after operation. Perineal packing and catheter when used are removed in forty-eight hours.

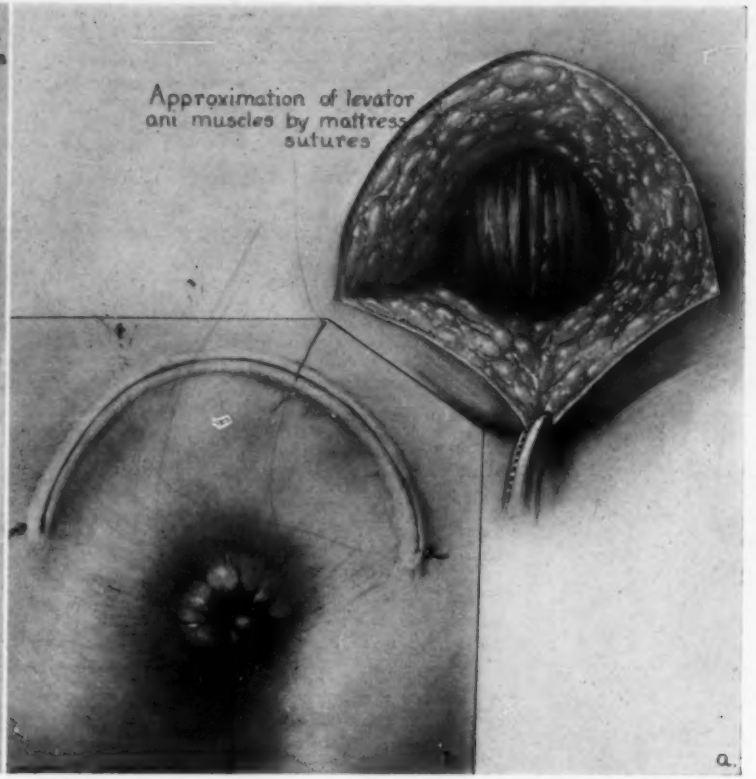

FIG. 14.—The final step in primary closure without drainage consists in approximating the retroprostatic tissues and levator ani muscles with mattress sutures of No. 2 Chromic (a) and the skin edges with a running subcuticular suture of No. 2 Chromic (b). (The skin flap is held by Allis forceps applied to the subcutaneous fat and not by a hemostat on the skin as shown by the artist.)

cases, but the results justify its use in every case in which it can be easily and quickly accomplished. Certainly, no one is entitled to pessimism with respect to this procedure without the justification of personal experience.

The accompanying figures illustrate the steps in the operative procedure so clearly as to obviate the necessity of written description.

CONCLUSION

It has been shown that primary closure and primary healing of perineal prostatectomy wounds can be successfully accomplished in a fair percentage of cases, contributing to the greater comfort of the patient after operation and shortening convalescence.

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HEREDITARY DEFORMING CHONDRODYSPLASIA OR MULTIPLE EXOSTOSES

REPORT OF A FATHER AND TWO DAUGHTERS SHOWING SIMILAR MULTIPLE SYMMETRICAL EXOSTOSES AND FIFTY OTHER CASES COLLECTED FROM THE ENGLISH LITERATURE SINCE 1917.

By Kelley Hale, M.D.
of Wilmington, Ohio

The above title of this most interesting condition is quite descriptive and was given first by Virchow, Ehrenfried [17] reports, although Mr. Cæsar Hawkins in 1837 was among the first to describe it under the name of *laminated exostoses*.[6] Some of the earlier writers state that these bony growths have been known for a long time.

An unknown disturbance of the physiology of the diaphyseal side of the epiphyseal cartilage results in a more or less symmetrical outgrowth of bony or cartilaginous tumors in or on the long bones situated at the diaphyseal ends mostly and also on the shaft. They are located mostly on the ends of the bones that have the greatest amount of diaphyseal growth and strange to say, these are the regions that are most frequently fractured during the first two decades of life. This point will be elaborated later in this paper.

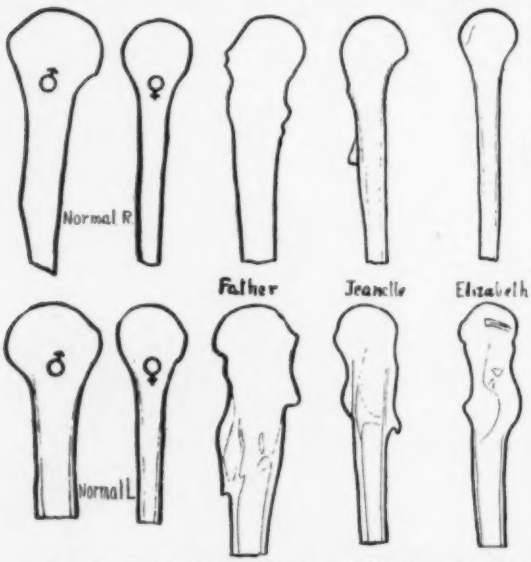


Fig. 1.—Proximal ends of right and left humeri. Left side more involved than right. Strikingly similar development gradating from eldest to youngest patient. Similar gradation on the right side.

These tumors are usually benign and a majority of cases are hereditary. Certain deformities are common due to the size of the tumors and abnormal development of the bones.

Ehrenfried [17] in 1915 reviewed the foreign literature carefully and in 1917 [19] the American literature representing some 600 cases in over 300 papers in the first and about seventy-three in the second. From 1917 on I have been able to add fifty cases reported in the English literature in addition to my own three.

I shall summarize the known facts and possibly inject a new idea into this subject. The facts recorded in the literature have been the result of keen observation by persons of renown who have left little new to report.

Terminology.—A multitude of terms proposed are listed in the articles of Ehrenfried,[17] Campbell [30] and Christian.[39] However the term adopted in this paper is considered satisfactory and self-explanatory.

Occurrence and Distribution.—The occurrence of this disease seems to depend directly upon the interest shown in it. According to Ehrenfried, since 1890, 60 per cent. were Germans, 27 per cent. French, 8 per cent. English, and other nationalities made up 5 per cent. Surgeons who have become interested in this disease in England and America have each discovered a number of cases in a comparatively short length of time.

Since the X-ray has caused us to lose the art of skeletal palpation, most cases thereby are not discovered. One of my patients had his leg amputated and the tumors were not discovered until thirty years after this and then only through their discovery in a daughter.

Further study may show that the condition occurs more frequently in countries that suffer the greatest amount of skeletal trauma.

From Russia, Italy, Japan, Denmark, Holland, Norway, Roumania, Bulgaria, Scotland, Ireland, Galicia, Sweden, Switzerland, Egypt, Argentina and India cases are reported, also two cases from New Zealand by White.[27]

Many cases have been discovered by a careful study of other members of the family.

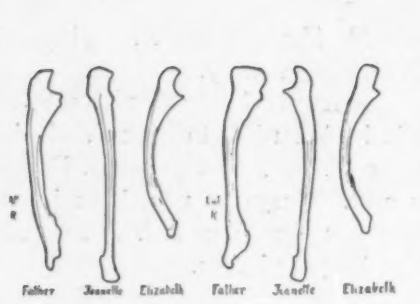
There may be great significance in the sex ratio as will be shown later. While the studies show different results, still the males greatly predominate. In 163 cases the ratio was 3 to 1, Reinecke;[17] 236 cases, 5 to 2, Ehrenfried;[17] twenty-nine cases, 3 to 2, Dwyer.[24] Lewin [34] says that this ratio of 3 to 1 is probably due to the increased risk of trauma in the male. Since 1917 the author in forty-five cases found a ratio of 3 to 1.

Meyerding [33] reported 265 exostoses in 232 patients; 150 males, eighty-two females. Most of the patients were of the laboring class; but no sure cases of hereditary chondrodysplasia were recorded. However the sites and order of occurrence are the same as in chondrodysplasia namely, femur, tibia, humerus, foot, fibula, scapula, ilium, supermaxilla, clavicle, mandible, radius, fingers, ulna, etc. This is similar to the distribution of sarcoma in the long bones, he says.

Percy [15] found in a family of 113, thirty affected with a ratio of five males to one female. In a given family in two generations were found twenty-one affected; another family in two generations had twelve affected and in two other families in three generations there were fifteen affected in each.

Few negroes are affected and in America, Anglo-Americans predominate.

Heredity.—While this disease is looked upon by all writers as a true hereditary affection because most cases give such a history, I believe more data should be presented in reporting cases in order to rest this assumption upon a firmer foundation. My observations were made upon three cases, a father and two daughters, a daughter and son being unaffected, which facts



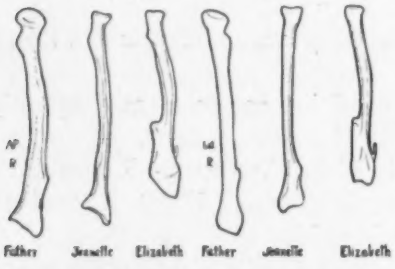
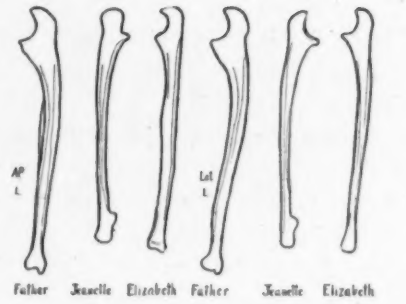


FIG. 2.—Right radii and humeri. The youngest patient shows greatest involvement. The father has the least involvement of the radius while Jeanette has least involvement of the ulna.



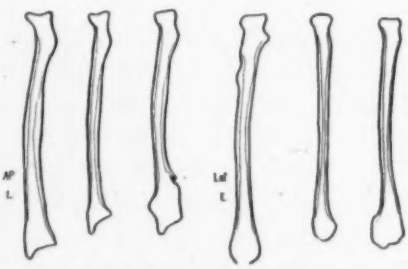


FIG. 3.—Left radii and humeri. The bones of both Jeanette and Elizabeth are of equal length but shorter than the father's. There is greater enlargement of Elizabeth's radius than Jeanette's. The reverse is true of Jeanette's ulna.

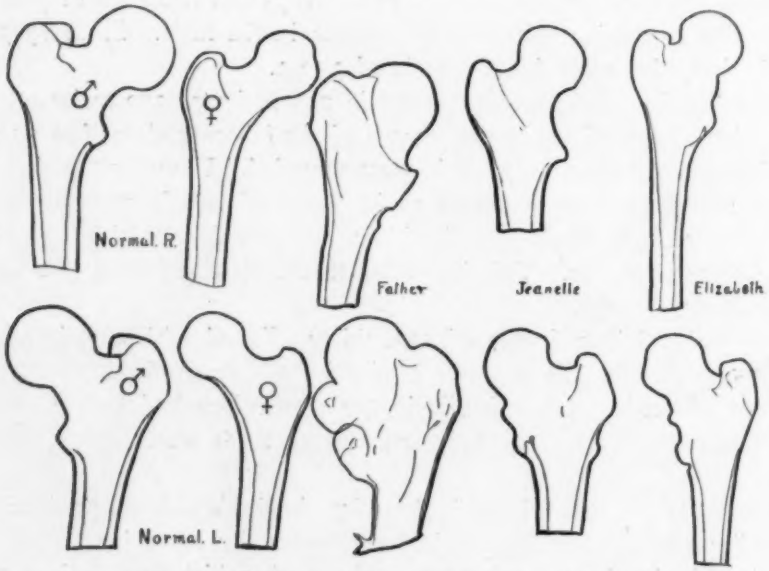


FIG. 4.—There is strikingly similar exostoses and development at the neck gradating from father to Elizabeth, the youngest. The right side shows less tendency to exostosis but abnormal development is present.

I believe will conclusively prove the hereditary idea as far as they are concerned.

At the request of Dr. Walter Simpson I presented these three cases before the Dayton Pathological Society in the winter of 1929. Doctor Simpson expressed the opinion that the facts given proved unquestionably that we were dealing with a hereditary disease. The fifty cases reported since 1917 show a big hereditary influence. Ehrenfried [17] says that it is now generally accepted that heredity plays the most important if not the only rôle in its occurrence. The condition has been transmitted by unaffected mothers and affected mothers have had affected children by different husbands. One father had affected children in two marriages, Gorsline.[22] Rarely

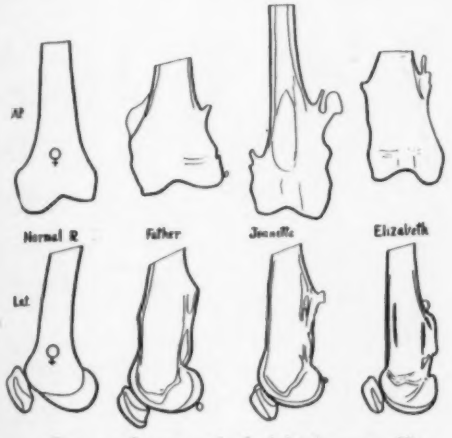


FIG. 5.—Lower end of right femurs. The development is quite similar in all three cases. Lateral view shows a striking developmental gradient.

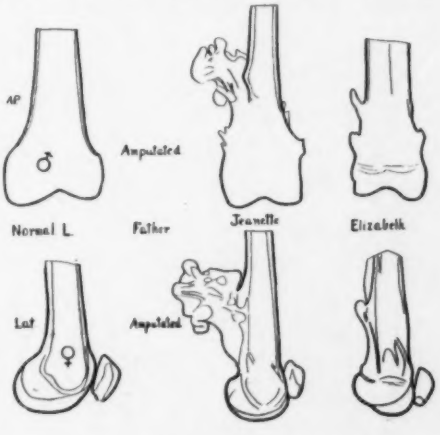


FIG. 6.—Lower end of left femurs. Father's femur amputated thirty years ago for so-called giant-cell sarcoma evidently a giant-cell tumor. Jeanette has quite a large cauliflower exostosis. Elizabeth shows slight tendency to the same development.

it skips a generation in affected families. Males transmit the disease more often than females.

The sex ratio of three males to one female, etc., would seem to indicate that in man germ cells are male and female from the start, that is sex-determined. It remains to be proven that an unaffected male can transmit the disease. I see no reason why it is not possible. Dwyer [24] corroborates Ehrenfried's observation on this point.

Keith [23] says that the disorder is Mendelian in its incidence while Oberndorf [10] in 1910 asserts that even those who insist most urgently upon the hereditary nature have been unable to establish any definite sequence or order in the matter of inheritance.

In cases where there is a negative family history we should not assume that heredity plays no part as many patients are wholly unaware of the presence of the affection as was the case in two of my patients. I believe that it is very important in these so-called non-hereditary cases for the doctor himself to undertake an investigation of the family if possible. The work

of Percy [15] has shown what is possible from such a study; thirty affected in four generations with a ratio of five males to one female. They were descended from a male. Ord [29] presents a genealogical tree in which an affected female transmitted the affection to three males and one female.

An accurate comparison of the tumors of identical bones from affected members of a family, individual and collective measurements of the long bones, will shed important light upon the problem of heredity. Outline drawings made from bony shadows on X-ray films are an ideal way to study this problem. Such a study of my cases shows clearly that nature is striving to strike a balance in the total lengths of identical bones, also as to the size of identically situated tumors.

In some respects the shunting of these germ plasm impressions in the

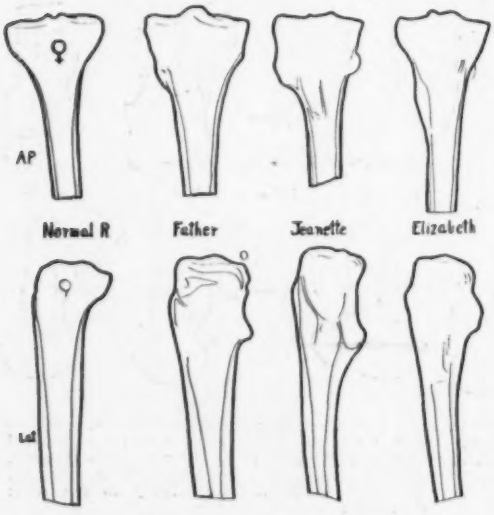


FIG. 7.—Upper end of the right tibiæ. Shows equal abnormal development.

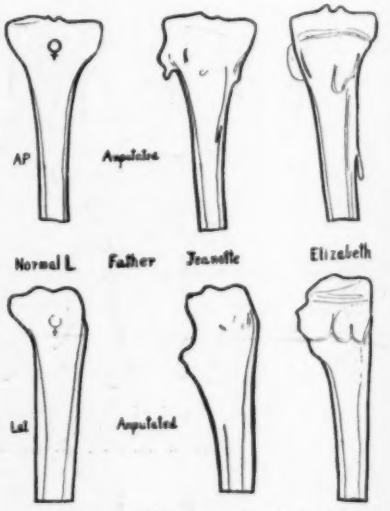


FIG. 8.—Upper end of left tibiæ. Father's tibia has been amputated and small exostoses of the daughter's bones are much the same.

different germ cells resemble the marvelous recording of associated ideas in our minds.

Supernumerary fingers, microdactylia and angioma are some congenital affections that may accompany this affection. They too are transmissable.

Pathology.—The X-ray has supplied most of our knowledge of the pathology of this disease. Enough tumors have been removed surgically to give us a very good idea of the gross and minute changes and two or three surgeons have been curious enough to remove a wedge of tissue across the epiphyseal line. It shows an irregular arrangement of the cartilage cells making up the intermediary cartilage. This cartilage, all are agreed now, is the seat of the trouble, the cells of which on the metaphyseal side being primordial or anlagal in character are responsible for products of their abnormal development. Cartilage proliferation and ossification are abnormal as shown by Ash at Harvard from a study of a piece removed by Ehrenfried.

Growth of cartilage seems to be excessive and calcification is extremely irregular. The diaphyseal end of the bones may be filled with masses of

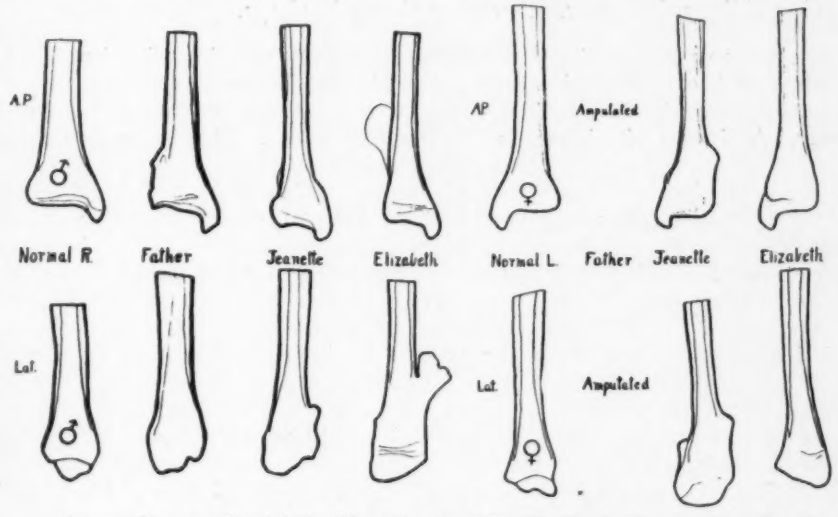


FIG. 9.—Lower ends of both tibiæ. On the right side the developmental gradient is in reverse to age. On the left side, the father's tibia is amputated but it would probably have shown a greater involvement than the two daughters. Nature seems to be striving to establish a normal development.

cartilage cells arranged often in parallel or irregular manner with their bony partitions producing the longitudinal striations. There may be some inter-

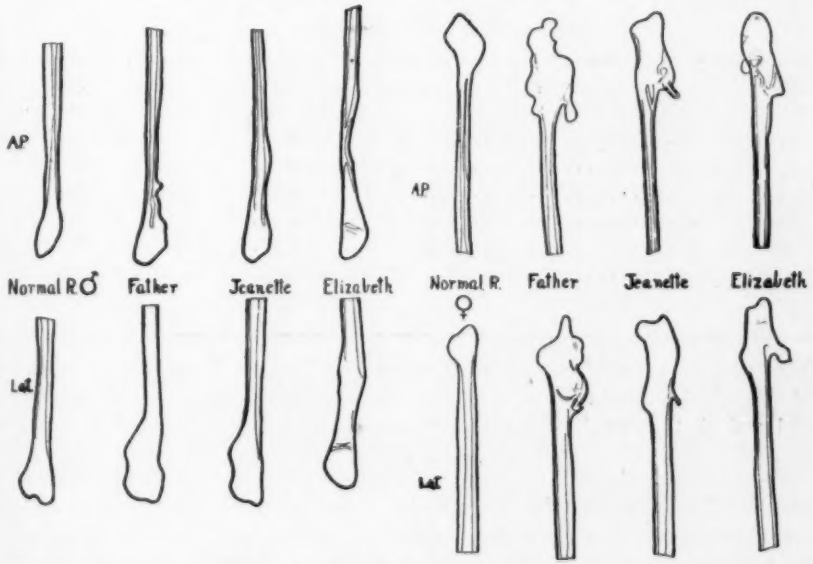


FIG. 10.—Lower and upper ends of right fibulæ. Shows a similar and equal abnormal development. Note the spurs on the upper end.

mingling of marrow. Under the microscope, Ehrenfried states that it looks not unlike chondroma. The bone cortex is thinned out and irregular cartilage gives the impression or appearance of cysts.

While the epiphysis seems to escape tumor formation, it is small or misshaped. Premature ossification of the mediary disc may occur in addition to being oblique, irregular, narrow or zigzag in shape.

KEITH,[25] an anatomist, has approached the subject in the right direction, I believe. He considers it a disorder of growth and not in the category of tumors. Nature, he claims, falls short in the normal modeling of bones, a process first studied by John Hunter. A diagram of this process illustrates this article. The former state he calls diaphyseal aclasis, suggested to him by Mr. Morley Roberts.

The cartilaginous exostoses or chondromas no doubt are due to this aclastic state whereby nests of cartilage cells uncalcified are left at first scattered in or under the thickened hyperactive periosteum and the end-result of their natural history is exostoses that may vary in size from that of a pea to many centimetres in diameter.

PERCY [15] removed an exostosis from the right humerus 13.5 centimetres by 12.5 centimetres by 11 centimetres. They do not possess unlimited growth or infiltrate. Typical cases resemble a cauliflower growth and have either a broad or a narrow pedicle. Meyerding [22] says that the history may disclose trauma or a hereditary basis.

CAMPBELL [20] reports the biopsy of a left tibia mass consisting of a bony shell with dense cancellous vascular interior. At places the shell was cartilaginous. There was no distinct base and the interior of the base was continuous with the marrow cavity of the tibia. Nearly all of these exostoses removed show a covering of more or less glistening cartilage and are covered with periosteum.

Spongy exostoses generally develop at the metaphysis of the long bones at the ends that show the greatest per cent. of growth in length, namely, the lower end of the femur, both ends of the tibia, proximal ends of the fibula, proximal ends of the humerus, distal ends of the ulna and radius.

HIGBY [13] reports the following showing the relative per cent. of growth in length of the following bones:

PROPORTION OF WHOLE DIAPHYSIS

	Formed from Proximal End of Diaphysis	Formed from Distal End of Diaphysis
Femur	31 per cent.	69 per cent.
Tibia	57 per cent.	43 per cent.
Fibula	60 per cent.	40 per cent.
Clavicle	62 per cent.	38 per cent.
Humerus	81 per cent.	19 per cent.
Radius	25 per cent.	75 per cent.
Ulna	19 per cent.	81 per cent.

OBERNDORF [10] under "Spontaneous Disappearance" states that Hartman [3] reports a case of great diminution in size of a bony tumor in multiple exostoses which he actually observed and that Starck [4] relates that according to the statement of a trustworthy patient, several bony tumors appeared and vanished completely as in Oberndorf's case. The latter points out that these authors report all the tumors absorbed before the patient reached his full growth. Oberndorf [10] reported a case of spontaneous disappearance in a German nineteen years old. Davis [6] reported a case where the tumor diminished in size.

BOGGS [37] says, "The cartilaginous covering of the exostoses is irregularly distributed and disappears during puberty when growth of the tumor ceases. Later some absorption may take place. In a few cases the tumors have entirely disappeared."

PERCY [15] reports a case, also WHITE [27] a case of a twenty-six-year-old patient with tumors from the humeri which were cartilage-capped.

GIBNEY [2] refers to a case in a boy of ten years in which an exostosis was broken

loose from its attachment and was completely absorbed in a year; also another case in which the doctor himself broke an exostosis from the bone near the knee but it reattached itself at another point.

COLE,[21] quoting from Bentzen says, "The pathological processes in the bony tissue may be assumed to be related to the phenomena seen in the formation of callus."

JENKINSON [25] says, "Exostoses may be either of two types, the flat table top or the irregular cauliflower variety. They are definite bone producers and show no invasion."

CAMPBELL [20] concludes, "The lesion is most typical and in greater abundance at those sites where growth is most rapid."

PAGET,[28] who always built upon the solid rock of fact, observed, "The bones of the hands are their most frequent seats; and next to these, the adjacent extremities of the femur and tibia, the parts which for some unexplainable reason appear to have in all the skeleton the least power of resistance of disease. After these, the humerus, the last phalanx of the great toe, the pelvis and the ribs appear most liable to cartilaginous growths."

Spurs are not uncommon and are to be found in my cases.

"The periosteum of the affected bones is to a moderate degree thickened and shows evidence of abnormal activity," states Christian.[29]

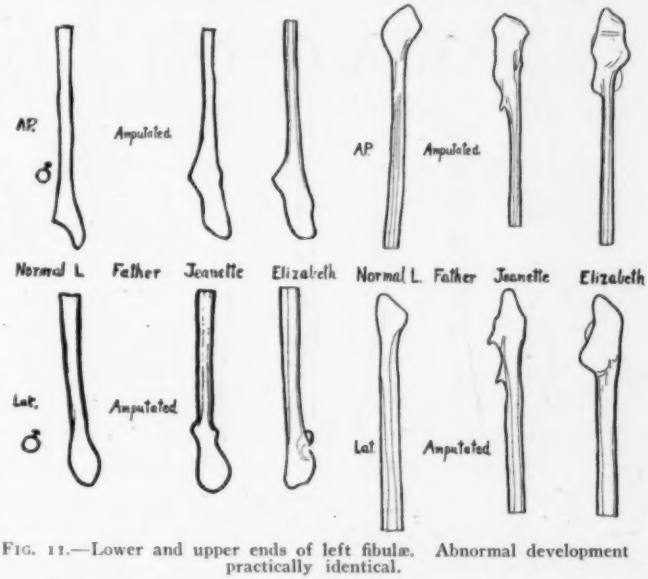


FIG. 11.—Lower and upper ends of left fibulæ. Abnormal development practically identical.

The lime salts are contained in greater amounts in the central portion of the tumors and the cortex of the bone shaft is continued into the dense bone of the tumors and the bone marrow likewise extends into the tumor. Observers in general have never noted the encroachment of such tumors upon the articular ends.

It was thought by some that the membranous bones were free from the formation of exostoses but reports of such occurrence show the frontal and occipital bones most frequently affected of those of the head. At the spheno-occipital junction is a typical site. The lower jaw a few times has been noted to be involved its entire length, Paget.[28] Halstead [23] reports one.

While the vertebræ are not so frequently affected, Ochsner and Rothstein [7] report an exostosis growing in the neural canal from the second cervical vertebra producing neurological symptoms from pressure.

All exostoses do not originate from the epiphyseal region.

Bones most often affected and their order are ulna, fibula, femur, tibia, humerus and phalanges, Davis [6] reports. For the most part they are distributed symmetrically.

Wright [4] in 1887 says that the sites usually selected are the ends of the femur, both ends of the tibia and the upper end of the os brachii.

Davis [6] states: "Many of the growths may appear within a short time or at intervals. The ulna, fibula, femur, tibia, humerus and phalanges are affected in most of the cases. They have been recognized from birth and therefore truly congenital."

The spine, pelvis, ribs, clavicles and scapulæ are not involved so much as the long bones. The large exostoses are capped over with a bursa to prevent friction and at times free, hard bodies are to be found in them.

Secondary Skeletal Deformities.—The legs and arms are shorter than normal while the body is not affected. Patients with this disease are always short, some dwarfed as a cretin. The longitudinal centre of the body in these is some distance above the normal pubic centre.

In Ollier's disease, the shortening of the extremities affects only one side, while in chondrodysplasia it is generally symmetrical.

The unequal growth in length of the two pairs of parallel bones, the ulna and radius, and the tibia and fibula, is responsible for other deformities considered characteristic. The radius usually grows longer than the ulna because it is less affected 'tis said; however a study of the radiographs of the reported cases does not bear out this last statement.

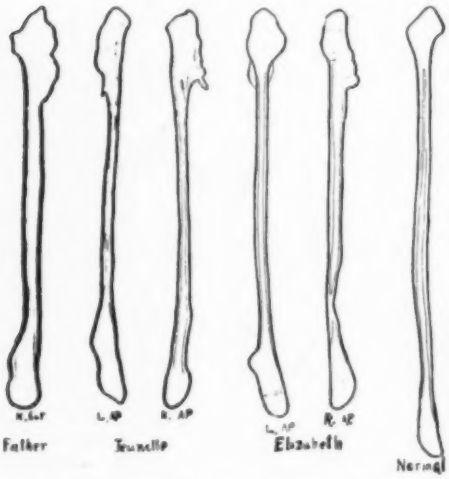


FIG. 12.—Shows the fibulæ of father and two daughters. All of equal length but much shorter in comparison to normal fibula of person of similar type and height.

If the wrist relations remain normal, the head of the radius at the elbow dislocates and at times the radius dislocates at the lower end, throwing the hand over to the ulnar side of the radius an inch or more above the wrist. See radiographs.

Instead of the above, the interosseous membrane may not be strong enough to withstand the strain so there is wide separation of the radius and ulna due to bowing.

When the fibula is greatly shortened, a high grade pes valgus develops and rarely varus. Scoliosis has been noted and the limbs are not always the same length. A composite picture of the extremities of all the affected extremities in a family with tumors might show a quite symmetrical length as I have noted in the metacarpo-phalangeal lengths of my three cases.

A deformed pelvis has been noted causing death in childbirth, Ehrenfried,[17] and the babe was affected. Long bones, as the leg and forearm and ribs, are sometimes bridged by exostotic processes.

"If excessive growth in the lower end of the tibia or ulna occurs, a pseudarthrosis or synostosis with the companion bone results," states Christian.[39]

This condition has often been confused with rickets because of a well-defined rosary, though both diseases may be present.

We can have deformed bones without exostoses, exostoses on normal bones and exostoses on bones with but slight deformities.

The disease usually does not progress after maturity although Davis [6] reports the case of a patient fifty-three years old who began to develop tumors after thirty years and in a few months they disappeared.

Pronation and supination are often interfered with as found in two of my patients.

In many cases the lower end of the ulna is the so-called arrowhead deformity. See radiographs.

There is no definite relation of the length of the bones to the amount and size of the exostoses but observations on my cases bear out the statement made by Ehrenfried [19] which denies Davis' [6] statement on this point. The heights of my patients are 55, 59 and 61½ inches respectively. Davis [6] states: "It is possible that the decrease in length is proportionate to the interference with destruction of the epiphyseal cartilage and not to a simple exhaustion of the osteogenetic supply."

Enchondromata are more common in the feet and hands than are exostoses. The tarsal and carpal bones are free from dyschondroplasia. In a study of 682 fractured bones, we found but two carpal bones fractured and eleven tarsal bones. The sternum seems to escape both conditions extremely well, too.

Complications.—Degeneration in the tumors has been known to cause cysts. This may be due to lack of blood supply or to pressure. Reports of blood-vessel injury and aneurism due to friction, particularly of the popliteal artery are reported; Freiburg, of Cincinnati, having reported such an aneuism years ago. The urinary bladder has been perforated by a spur of this nature, likewise the pregnant uterus. Pelvic exostoses have caused the death of a woman in childbirth. Infection of overlying bursæ have been noted. Ehrenfried [17] found that about 5 per cent. of the reported cases were complicated by malignant osteo-cartilaginous tumors.

CAMPBELL [20] reports a typical case, the father dying of cancer of the stomach, the mother of cancer of the throat. Case I, father of Cases II and III of my own herein reported, had his left leg amputated for so-called giant-cell osteosarcoma at the age of twenty-nine years and at thirty-eight years had two epitheliomas removed from his forehead.

Neurological Complications.—Oberndorf [10] quotes from Starck a case of "spastic paralysis" of the legs, probably through pressure on the cord due to an exostosis in the neural canal of the third dorsal vertebra. Oberndorf [10] reports a fatal case in a patient who had analgesia and thermoanæsthesia due to pressure on the cord area.

Ochsner [7] describes a case with an exostosis nearly filling the neural canal of the second cervical vertebra with cord pressure symptoms on the right side of the cord. Operation.

Dwyer [21] notes the following neurologic manifestations; acromegalic symptoms from a sella turcica growth and ulnar and radial nerve involvement.

Ehrenfried [17] reports two cases of the peroneal nerve in a hyperostosis.

Ashhurst [18] reports paralysis of the left ulnar nerve due to pressure of a bony mass in the neck of a boy of fourteen years while in a man of thirty years an exostosis on the left femur caused rheumatism by pressure on the sciatic nerve. The tumor was removed.

Cole[31] collected four cases of hemiatrophy of the face in Ollier's disease, this coinciding with the side involved. Bentzen, according to Cole, considered this an indication of a lesion in the upper sympathetic cord and experimented on rabbits, destroying the sympathetic cord and injecting alcohol in the region of the nutrient artery of a bone to

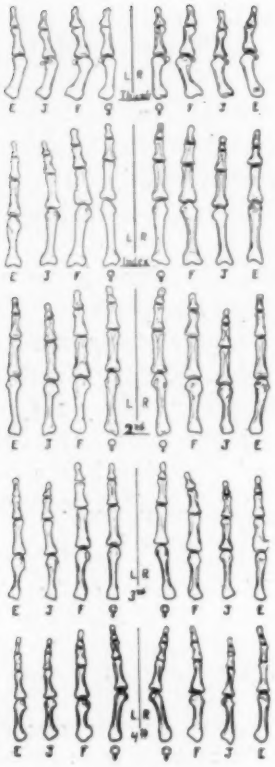


FIG. 13.—Comparison of the right and left carpo-phalangeal bones of the three patients and those of a normal similar type of individual. The abnormal development is mainly in the length of the respective units. See Fig. 14 for graphic representation.

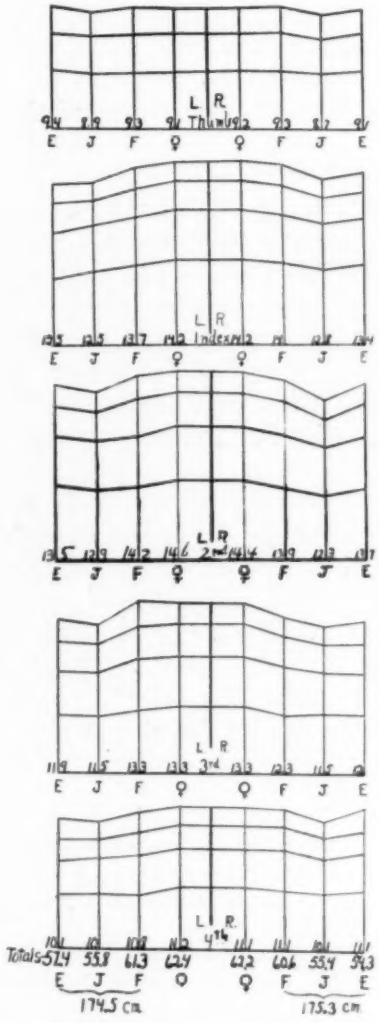


FIG. 14.—Graphic representation and measurements of the units of the right and left carpo-phalangeal bones showing how nature has balanced the total lengths of these bones of the right and left hands to within a difference of only 8 millimetres. A very remarkable endeavor on the part of nature.

knock out the sympathetic. He obtained results in two cases analogous to the appearance of bones in Ollier's disease.

Most writers are now of the opinion that this is identical with chondrodysplasia because in some cases a few exostoses can be demonstrated on the normal side. While at least one case report I found showed a typical case of chondrodysplasia transmitting but a few tumors to an offspring.

Cleveland[36] was able to collect fifteen cases of Ollier's disease in the literature, including his own.

A few years' study into the genealogy and the offspring of this small group of individuals certainly would clear up the much-disputed point of whether Ollier's disease is a distinct clinical entity.

The reports of my cases are herewith presented.

Case I.—J. B., aged fifty-eight years, male, married, height 55 inches, weight 180 pounds, discovered at seventeen years of age a small lump on the inner side of his left knee with no history of injury. The lump gave him no pain or discomfort for eleven and one-half years, then he complained of stiffness in the left knee and the tumor

Fig. 15.—Humeri of Case I.

increased to a circumference of twenty-two inches in six months. The knee had to be immobilized to give him any comfort. He was examined by Dr. J. E. Russell,[5] of Cincinnati, who reported the case as sarcoma in the *Eclectic Medical Journal*, vol. lx, 1900. The following is quoted from his paper.

"An X-ray of the tumor gave a shadow showing a great enlargement of bone tissue with serrated edges protruding with the soft tissue. Limb amputated December 20, 1899, at Cincinnati General Hospital. Stump left, allowing for use of artificial limb. In case of a recurrence in the osseous structure, the bone could easily be removed. Uneventful recovery. Examination of the photo-engraving shows that the condyles of the femur remain normal and free from the malignant cell growth. It will be seen that the bone was excavated and that a very thin shell was all that remained to hold the limb from fracture and destruction. Photo-engravings show the different malignant cells."

The patient has never been able to wear an artificial limb.

Past History.—He had two epitheliomas removed from his forehead at thirty-eight years of age. He believes that he fractured his right arm below the elbow in childhood. Other history irrelevant.

Family History.—Father's left leg was greatly enlarged and had a "sore" on it. No history of bone tumors in the family.

The sites of exostoses will be noted and compared with the cases of the patient's two daughters at the end of these case reports.

Case II.—J. B., daughter of Case I, female, aged nineteen years, single, height 59 inches, weight 109 pounds, short, stocky stature, at five years of age had a bone tumor the size of a hickory nut removed from her left humerus three inches from the shoulder by Dr. J. E. Russell. The patient grew normally but the left arm was never as long as the right. At thirteen years, a hard mass was discovered on the inside of the left thigh three inches from the knee. She was lame for eight years, swinging her left hip around favoring that side. A few years ago she complained of sharp, catching pain in the tumor region and got relief by swinging her leg. The tumor has grown at about the same rate as her body growth.

Fig. 16.—Shows shortening and bowing of radius and ulna in Case III.

Past History.—Has had rheumatism in her right knee; thirty boils on her head before one year old, goitre in early adolescence, bronchitis every winter until recently and has always been nervous.

Family History.—Father and one sister have multiple exostoses; one sister and one brother and his little daughter are free from these tumors.

Case III.—E. B., daughter of Case I, aged fifteen years, single, blond, height 61½ inches, weight 96 pounds. When she was a few months old a three-cornered knob was discovered on her right arm about two inches below the elbow on the posterior surface. At one year of age she fell, throwing her arms out to catch herself. After this the knob disappeared. At this time, it was thought that she had fractured her arm and she complained of pain. At twelve years, while carrying a shovelful of coal, something snapped in her right arm above the wrist. She could push the bones into different positions until she could get relief from pain. She is unable to lift anything with this arm, which is not growing so rapidly as the left. She has been lame until recently, favoring her right side. She is knock-kneed and cannot bring her ankles together. At twelve or thirteen she complained of pain shooting from her left shoulder into the left side of her body. Was unable to lie on her left side and also complained of pain around her left hip-joint and of "catches" in her left knee.

Past History.—She had pneumonia at five years, the usual childhood diseases, tonsillectomy at eight years and operation for tuberculous peritonitis at thirteen years. *Family History.*—Same as Case II.

Occurrence of Exostoses in these three cases.—Right Humerus.—Case I.—From the anatomical neck it is affected for 11 centimetres down the shaft, quite irregular; bone tapers down to 3 centimetres; some irregularity about the internal condyle. Case II.—Similar affection except lower end is negative. Case III.—Slight thickening of periosteum in mid portion.

Left Humerus.—Case I.—Upper portion 12.5 centimetres down the shaft is irregular in outline, averages 5 centimetres in diameter; has characteristic longitudinal striations with very thin cortical bone. Cases II and III present proportionately the same condition.

Clavicles.—Inner portion thickened in each case. Cases I and II have thickening of the acromial ends and Case III has an exostosis on this end.

Right Radius.—Case I.—Marrow cavity larger than normal; thickening of bicepital tubercle; head greater diameter than normal, suggestion of exostosis 6 centimetres from lower end with thin cortex and irregularly shaped marrow space and has more bowing than the left radius. Case II.—Thickening at the wrist for 4 centimetres up the shaft; 1 centimetre longer than the ulna at wrist and has slight outward bowing. Case III.—Marked bowing; some increase in size of bicepital tubercle; lower end 2.5 centimetres to 3 centimetres thick for distance of 6 centimetres; small spur on external surface.

Left Radius.—Case I.—Irregularity with tendency to slight exostosis near the head and thinning of the cortex; thickening and enlargement of the lower end; slight bowing. Case II.—Outward bowing; .5 centimetre longer than ulna at wrist. Case III.—Lower 5 centimetres thickened with small exostosis in similar position to spur on right radius.

Right Ulna.—Case I.—About 2.5 centimetres short; outward bowing; thickened for about 5 centimetres; does not engage in wrist-joint articulation; typical arrowhead deformity. Case II.—Flat exostosis 2.5 centimetres above rounded end. Case III.—Marked bowing; 2.5 centimetres from wrist articulation attached to side of radius.

Left Ulna.—Case I.—Exostosis size of a split pea on the coronoid process about 1 centimetre from articular surface; outward bowing at junction of upper and middle thirds. Case II.—Flat exostosis 2.5 centimetres above rounded lower end. Case III.—Does not articulate in normal manner to side of radius.

Right Femur.—Case I.—Greatly thickened and short neck; greater trochanter practically on level of top of the head of the femur. The former is much thickened, has longitudinal striations; lesser trochanter increased in size; shaft thickened a distance of 12.5 centimetres from lower end; crater-shaped exostosis on inner side 1.5 centimetres high attached along base 5.5 centimetres; two spurs 1 and 2 centimetres on outer side 9 centimetres from articular end and point upward; cortex thin; longitudinal striations; small round body in posterior part of knee-joint. Case II.—Head of bone similar to above; no exostoses; cancellous architecture abnormal; uniformly thickened shaft for 10.5 centimetres from the articular end; slight spur on posterior surface and a small round body in the posterior part of the knee-joint. Longitudinal striations; small spur 5 centimetres from lower end; inner side has one sharp and one globular spur about 10 centimetres from end; average diameter of shaft 6 centimetres. Case III.—Head similar to above; neck has tendency to vertical direction; two spurs at lower end on external surface directed upward, 2 centimetres and 5 centimetres from the epiphyseal line respectively; slight exostosis on inner surface; longitudinal striations.

Left Femur.—Case I.—Shows entire stump left from amputation; head similar to right side; round exostosis developing from neck 3.5 centimetres by 3.5 centimetres with broad base; spur 2 centimetres long on end of stump; longitudinal striations. Case II.—Similar to Case I. Also small rounded exostosis below greater trochanter externally; at lower end, lateral view shows cauliflower exostosis 8 centimetres by 8 centimetres with rather broad pedicle and has cancellous structure and longitudinal striations. Antero-posterior view shows same large exostosis and two or three small spurs on the external surface 6.5 centimetres to 10 centimetres above the knee-joint; longitudinal striations. Case III.—Not as thick as right side; slight exostosis above the lesser trochanter and neck; lower end similar to right.

Right Tibia.—Case I.—Upper end at knee widened; cortex very thin; some longitudinal striations; exostosis where it articulates with fibula also at lower end and has lateral contact with fibula for 4.5 centimetres; appears to be a synarthrosis and seems to have a depression in lateral aspect of fibula along this attachment. Case II.—Small exostosis on inner tuberosity 4.5 centimetres from end with longitudinal striations; lower end shows lateral thickening with small exostosis on external surface 3 centimetres from end. Case III.—Slight broadening of the upper end; some tendency to exostosis

at articulation with fibula; lower end has marked exostosis 6 centimetres above epiphysis 4 by 2 centimetres. Laterally it is pedunculated and has caused considerable absorption of inner surface of the fibula due to pressure.

Left Tibia.—Case I.—Leg amputated. Case II.—Similar exostosis as on right upper end; flat, plateau-like exostosis on fibula side of bone about 5.5 centimetres in length; very small flat exostosis over internal malleolus; tibia and fibula intimately united. Case III.—Moderate sized exostosis on inner surface of tuberosity; long spur 2.5 centimetres at junction of upper and middle thirds.

Right Fibula.—Case I.—The head of the upper end shows marked enlargement for 7.5 centimetres; irregularly shaped; longitudinal and transverse striations; greatest diameter about 8 centimetres; globular-shaped exostosis hangs down on inner aspect between tibia and fibula 3.5 centimetres by 1.5 centimetre. Lateral view presents cystic appearance; a small round cartilaginous body is in posterior aspect of joint. Bone angulates at 8 centimetres from its lower tip. Case II.—Upper end considerably enlarged and involved for 7 centimetres; two spurs, 3 centimetres in diameter are at the lower portion of that area directed downward; at lower end an inward angulation about 7 centimetres above the end on the inner side present. Case III.—Marked thickening of the head affecting the diaphyseal end; spur on this part; lower portion of bone absorbed by pressure by exostosis on tibia.

Left Fibu'a.—Case II.—Upper end similar to right; shaft narrower than right; considerable thickening for 7 centimetres of lower end; rounded exostosis towards tibial side causing a firm union between the two bones. Case III.—Typically involved but not to extent as on the right; exostosis 3 centimetres on inner surface of lower end.

Scapulæ.—Case I.—Some irregularities in axillary and vertebral borders; great thickening of neck and glenoid cavities; hanging like a drop on either coracoid process is an exostosis 2 centimetres long and 1.5 centimetres in diameter. Cases II and III present the latter condition.

Ribs.—Case I.—Marked exostosis 4 centimetres in diameter on third rib on left side, 3.5 centimetres from head of rib, presses against the upper surface of the fourth rib causing downward bowing and appears to be attached to the rib. Case II.—Calcification of cartilages on left side. Case III.—Slight affection of right third rib near spine.

Hands.—Case I.—Irregularity in length of metacarpal and phalangeal bones with slight equal affection of the phalanges of both hands. Case II.—No exostoses but irregularity in outline and difference in length of bones. Case III.—Irregular slight affection of metacarpal and phalanges. Marked irregularity in length of bones.

Feet.—Case I.—Slight affection of metatarsal and tarsal bones; short spur at base of first metatarsal. Case II.—Minor involvement of metatarsals and phalanges; tendency to tumor formation. Case III.—Same as Case II excepting latter condition.

Pelvis.—Case I.—Irregular in shape due principally no doubt to weight bearing performed by the right leg; irregularity in symphysis pubis; pubic rami thickened and slightly irregular; minor changes in iliac crests, left larger than right somewhat. Case II.—Distortion of rami of pubic bone; irregularity in outline; abnormality of symphysis; exostosis near the crest of both iliac bones about 3 centimetres in diameter. As they are observed through the bone, it is impossible to say whether they are inside or outside of the bones. Case III.—Similar to Case I; wide separation of pubic bone.

The Etiology of Chondrodysplasia is unknown. It leads us to revolve in our minds the various diseases affecting the development of the skeleton for it is classed in the same category. Rickets is the first to be thought of, osteomalacia, fœtal chondrodystrophy, dwarfism, giantism, osteogenesis imperfecta, acromegaly and cretinism; while rickets may be associated with this disease still the microscopic changes are entirely different.

Because thyroid disease has the same geographic distribution as chon-

drodysplasia, some have thought the thyroid an etiologic factor. We would expect more uniform affection of the skeleton in cases of endocrine disturbance. It would be hard to believe in such a cause for Ollier's disease. However a trophic disturbance of the central nervous system would fit in more reasonably with the facts observed. Neuro-syphilis if the above were true certainly would account for some cases but syphilis has been proven to play no part in its causation.

Infection has been thought to be a cause. With this idea in view I fed blood and saliva from my patients to fifty pairs of white mice but was unable to obtain bone tumors in any of their progeny.

Tuberculosis is probably the most commonly associated disease; the reason given for this is that the general resistance of these patients is low. One of my patients, Case II, was operated upon by me for an accumulation of tuberculous fluid about her appendix region during the course of my study of her skeletal system. Her recovery was uneventful.

Keith,[23] who is an anatomist striving to get a peep into nature's growth mechanism, says: "This disorder should be definitely placed among the disorders of growth." After weighing the facts of the various theories I am convinced that Keith is correct. However he describes in a very convincing and interesting way what takes place in the development of these tumors but leaves us wondering what causes the periosteal ferrule, as he calls it, to lag behind in its growth. But the germ plasm will give us no answer to our question for we will find the mystery hidden in the somatoplasm. In my three cases heredity unquestionably exists. It is now taught and believed that the soma has no influence upon the germ plasm due first to the teaching of Weissman and second to lack of convincing evidence to the contrary. While long ago Lamarck in his "Zoölogical Philosophy" taught that acquired characters are transmissible, thus clearly explaining the variations seen in fossils and laying firmly the foundation for evolution a theory of use and disuse of parts years later. While every scientist accepts the theory of evolution proven so abundantly in the field of paleontology, still practically to a man, they deny somatic influence upon the germ plasm.

Doctor Parker, of Harvard, in a series of lectures at Ohio State University on evolution and kindred subjects said he would like to believe in the inheritance of acquired characters but that every scientist who has attempted to prove it has met disgrace and consequently no self-respecting scientist today will espouse its cause.

Even the pet idea of Darwin, natural selection, according to Doctor Parker does not work, if at all, in the grand style of its creator. Weissman's argument against the inheritance of acquired characters was based upon the experiment of cutting off animals' tails with negative results in the offspring.

Common sense would tell one that all the fundamental plans of organization and function in order to preserve and perpetuate the specie would have to be laid down at a time before the individual was exposed to the vicissitudes of environment. However this does not preclude the influence of

refined and minor cumulative somatic influence and in rare instances possibly grosser somatic influence; to wit: a neighbor of mine when a boy had his left arm and leg amputated by a railroad car and he had a daughter with a half-length left arm. This may be merely a coincidence.

To expect a result such as Weissman argued against, one would have to remove the anlage of a tail or other part before it could influence the germ plasm to get the desired effect. This is really what happens when experiments are made upon eggs in the pre-gastrula stage, the so-called vital record or directing force of ontogeny is wholly or partially destroyed.

FIG. 17.—Case II.

I have spent many years experimenting upon the eggs of fresh water snails and by various physical and chemical means, a great chain of monsters was obtained grading from those of a few live cells through shell-less forms and a perfect grade of shells from a mere flat disc to the perfect normal stage. To my mind these monsters represent evolution in retrospect.

In many respects a germ cell is similar to a nerve or brain cell and while the latter can have all kinds of environmental influences recorded in or upon it in a manner still unknown to science, yet a visit to a museum of paleontology certainly will convince one that something has been added to or subtracted from the germ cells that produced the specimens one sees when

compared with the early and late members of the specific form; an example is the horse.

To understand this marvelous fact, we must assume that there is a mechanism in the germ plasm which is more or less responsive to the environmental experiences of the soma, although it may require thousands of years to make changes. Every differentiated or undifferentiated cell in the body can be traced through an unbroken chain of cells to the germ cells from which they sprang.

In the case of bilateral animals, the gastrula consists of two sets of similar cells but they are right and left handed. At the end of this stage experiments upon the eggs have no effect on the final result, thus showing the controlling mechanism is fixed at this stage, a well established fact.

So theoretically we represent graphically the descendant cells of each gastrula cell by a figure like the web of a spider. It is bilateral and the spiral threads serve to keep the two sides coördinated and timed. Now if we assume that this figure possesses all plans or records of the mature animal and capable of controlling all the intricate processes of ontogeny, we have exactly the figure that I discovered in the egg of the physa, a fresh water snail. It is situated just beneath the inner cell membrane and definitely oriented in the egg.

Many years of experimenting on these eggs have inclined me to believe that it controls the ontogeny of the snail for when the gastrula stage is drawn into capillary glass tubes, development continues while earlier stages so treated stop at the gastrula stage because they have been removed from the influence of the controlling mechanism, I assume.

Reversion of animals or birds to some former condition is a well-established fact, an example being the reversion of a domestic pigeon to the rock pigeon as described by Darwin. Every flower gardener knows how quickly certain flowers become wild again. Just as individuals may be born having lost most all of the parental distinguishing characteristics, having reverted, others may come forth as described first by De Vries, a Dutch botanist, a new species, a mutant or sport.

A record of the new character must have been carried through hundreds or even thousands of parents perhaps, each adding its bit of experience which undoubtedly the germ plasm was able to record. Finally this experience becomes dominant and able to assert itself and the mutant is created. Time and experience are the two important factors plus an adequate and marvelous recording mechanism which is apparently as intelligent as instinct, in fact if they are not the same thing, they walk hand in hand and of equal kin to chemical affinity.

After reading Sir James Paget's article on cartilaginous tumors an idea occurred to me that multiple exostoses may be due to impressions made upon the germ plasm consequent to fractured bones and their complex healing processes in past generations to the number sufficient to afford at least one record for every bone, right and left, that is affected in a typical

case of multiple exostoses. Just how many times a particular bone or group of bones must be fractured and through how many individuals their records must be carried before an individual blossoms out as a sport or a mutant with a crop of exostoses able thereafter to transmit the same to offspring in a Mendelian fashion, I confess my inability to answer.

Furthermore as all kinds of fractures occur during youth while the epiphyseal cartilages are still active and possibly able to make some sort of germ plasm impression or record of the injury; we have a further reason for believing it possible to record upon the germ plasm for the carpal, tarsal and vertebræ are so infrequently fractured during the first age period that they remain practically free from tumors.

No doubt many individuals do not possess the full measure of the protective barriers nature has furnished in a special mechanism which protects the germ plasm from abnormal influences. Theoretically, it is not necessary for the first individual affected to have a full complement of tumors. There is proof that a patient with a typical set of tumors can transmit to an offspring only a few tumors. Of course all children of an affected parent are not affected.

The hereditary nature of single exostoses has not been studied very carefully. Their distribution, however, is rather typical of the hereditary affection. Patients with a single exostosis may belong to a susceptible type analogous to Maud Slye's mice that show a predisposition to cancer and a trauma may initiate an exostosis.

The spontaneous disappearance of exostoses, a well-established fact and observed in one of my patients, seems somewhat analogous to the absorption of callus in fractures.

Exostoses most commonly occur on the end of the long bones that have the greatest per cent. of growth in length.

In order to offer some proof in favor of my evolutionary theory of exostosis, Miss Kathryn Williams, who made the X-ray films of my three cases, undertook the study of our records of 682 fractured bones that have been radiographed in our private laboratory during the past few years. What I had in mind was to check up on the sex ratio, the bones most commonly fractured, the site of injury and the age incidence.

We assume that germ plasm impressions would be more easily made during the first age period, one to twenty years, but it is quite possible that it may be active through life, but in the female after forty these impressions would be rendered practically impotent because of the end of the reproductive period. In the male, however, reproduction often occurs late in life. This point should be considered in a study of the sex ratio 3 to 1.

The statistics Miss Williams presents are as follows:

In 682 fractured bones 451 were males and 231 females; 25 per cent. of the male fractures and 23 per cent. of the female fractures were due to automobiles. The number of bones fractured on the two sides of the body was found to be equal in both sexes.

In the male miscellaneous cases, there were more fractured by fifty-six on the left side than the right but the automobile fractures have a ratio of three right to one left; while the female fractures are equal in both auto and miscellaneous cases.

The ratio of male to female is 2 to 1; in miscellaneous cases, 3 to 1; and in auto cases, 2 to 1.

The bones most frequently fractured are given in the order of occurrence in 521 miscellaneous fractures, not automobile.

Radius 20 per cent.	69 per cent., lower third	50 per cent., 3rd age period
Humerus 12 per cent.	50 per cent., lower third	84 per cent., 1st age period
Femur 11.7 per cent.	81 per cent., upper third	92 per cent., 3rd age period
Ulna 11 per cent.	60 per cent., lower third	55 per cent., 3rd age period
Tibia 9.6 per cent.	76 per cent., lower third	63 per cent., 3rd age period
Fibula 9.6 per cent.	66 per cent., lower third	51 per cent., 3rd age period
Phalanges 3.2 per cent.		17 per cent., 3rd age period
Head 3 per cent.		18 per cent., 3rd age period
Pelvis 3 per cent.		31 per cent., 3rd age period
Metacarpus 2.8 per cent.		6⅔ per cent., 3rd age period
Metatarsal 2.6 per cent.		42 per cent., 3rd age period
Tarsal 2.3 per cent.		45 per cent., 3rd age period
Clavicle 1.9 per cent.		20 per cent., 3rd age period
Ribs 1.9 per cent.		50 per cent., 2nd age period
		40 per cent., 3rd age period
Scapula 1.1 per cent.		43 per cent., 3rd age period
Vertebra 1.1 per cent.		100 per cent., 3rd age period
Phalanges (foot) 1.1 per cent.		33⅓ per cent., 3rd age period

I believe these figures will speak for themselves when compared with the statistics on hereditary chondrodysplasia. If this increase of 25 per cent. of fractures due to auto accidents continues, one might imagine what effect it will have upon the human skeleton 50,000 years hence. If this evolutionary idea is correct, then we have at last a real proof that the soma can influence the germ plasm.

It is said that these tumors occur in animals but they must be extremely rare for it would be a simple matter to detect them in the cuts made from millions of slaughtered animals. The reason for this is that most animals are destroyed when they have fractured legs. While in wild life, the injured are always preyed upon by their own or other species and consequently there is small likelihood of such injured animals being able to survive and perpetuate themselves, while in man, the moral sense has saved these individuals through man's power to aid nature in her healing process, particularly in those of bone repair.

Symptoms.—Outside of partial loss of joint function from a large exostosis or pain from a pointed exostosis, most of the symptoms are due to the various complications already mentioned. Many patients are practically symptomless and entirely ignorant of the presence of the disease.

Diagnosis.—Most cases are easily diagnosed from the X-ray films as the appearance is quite characteristic.

Treatment.—No treatment is indicated except to facilitate joint function or to correct a deformity that is disabling. Maturity is the time indicated for corrective operations. Many of the complications demand surgical interference.

Remarks.—I have been interested for many years in the study of neoplastic and malignant growth through the viewpoint of embryology and cytology. The present I think affords a lot of stimulus for study and observations along this line.

If my assumption of the cause of chondrodysplasia has a grain of truth in it, we then have a glimpse of the entire cancer sequence, for 5 per

FIG. 18.—Case II shows large exostosis on lower end of left femur.

FIG. 19.—Case III. Note exostosis on lower third of right tibia pressing into fibula.

cent. of these tumor patients develop malignant bone growths. Cancer patients in general might be considered to have been made susceptible through transmission from past generations of various obnoxious environmental experiences.

It is known that farmers, teamsters, laborers and those exposed to the irritation of sun, rain, cold, wind, dirt and other irritations are more susceptible to skin cancers of the face and hands than those not so exposed. I think a long list of gastric ulcers in a patient's genealogy is far more potent for cancer than the possession of an ulcer itself.

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TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY

STATED MEETING HELD MARCH 12, 1930

The Vice-president, Dr. John Douglas, in the Chair

SUPRA-ORBITAL EPITHELIOMA

Dr. Robert H. Kennedy presented a man, aged sixty-three years, who was admitted to the Beekman Street Hospital June 11, 1926. Six weeks before admission he had developed a small lesion above the right eyebrow which appeared to be a furuncle. He was certain that there had been no lesion at this site previously. It broke down and discharged pus, but then failed to heal. He came to the clinic for about two weeks before hospital admission, where on account of the sluggish healing a biopsy was made and reported to be squamous-cell epithelioma.

When admitted there was an ulcerated circular lesion in the right supra-orbital region two centimetres in diameter. The edges were raised but only slightly indurated and there was a sloughing base apparently not attached to bone. One hard, freely movable node was present in the right parotid region. There were several small shotty nodes in the posterior cervical triangle. June 14, under local anæsthesia, the area was excised down to the deep fascia with normal skin one centimetre wide surrounding lesion. The skin was undermined and closed, the upper and lower eyelids also being sutured together to prevent ectropion. The lymph node was then dissected from the parotid region and skin closed. The wounds healed by first intention. *Pathological Report.*—Squamous-cell epithelioma in both lesions.

Due to the metastasis found after a history of six weeks only it was felt that the condition was a highly malignant lesion, and that further operative procedure would not be proper. However, he was given a thorough course of X-ray therapy to the parotid region and the cervical lymphatics.

He has been seen frequently in the follow-up clinic. Some soft nodes have been felt constantly in the submental and both carotid regions. They have not changed and are probably due to mouth infection. The patient insists that they were present for a number of years before operation. It is now three years and nine months since operation without evident recurrence. He was presented as an example of prickle-cell or squamous-cell epithelioma of the skin not arising on an old scar and not at a muco-cutaneous junction. Such lesions on the face are most likely to be considered basal-cell epitheliomata which respond readily to treatment by radiation. Squamous-cell epithelioma, however, responds poorly to radiation and such patients should be advised to have such a lesion excised if it has not disappeared after two treatments by radiation. If it proves radioresistant there is a real possibility that one is dealing with a prickle-cell lesion of the skin which is not rare and which demands thorough surgical treatment. A basal-cell lesion does not metastasize at any time, but a prickle-cell lesion may metastasize early, as seen in this case. This patient also demonstrates the value of early biopsy in a lesion which fails to respond to treatment.

Dr. George H. Semken said that the usual types of epithelioma found in the skin of the face are the basal-celled and the squamous-celled. The basal-celled types were definitely classified by Krompecher in 1903 (in his monograph "Der Basal-cellen Krebs"). A third type of epithelioma, the "intermediate" or "mixed" type, was added by Darier in 1922 (*Annales de Dermatologie et de Syphilographie*). All three types have a common ancestry in the germinal layer of the epidermis; but while the basal-cell type retains the fœtal, cuboidal form throughout and grows in nests and strands, the squamous-cell type undergoes differentiation through the prickle stage to keratinization in varying degrees, and is irregularly invasive. The intermediate or mixed type is made up of both types of cells, some remaining cuboidal and others being differentiated in the form of squamous cells. It probably constitutes a true type with mixed genetic factors, rather than a transition from basal cells to squamous, during the tumor development, as was formerly believed. The basal-celled epitheliomata are considered radiosensitive while the intermediate and squamous-celled types are radioresistant. It would not be wise, however, to apply this criterion in the clinical attempt to determine the histological structure of any of the epitheliomata, as Doctor Kennedy suggested, for many of the basal-celled epitheliomata have proven radioresistant also, in part or whole. With so serious a process as cancer, it would seem wisest to remove the lesion completely, in a definitely certain manner, by one of the recognized methods of surgical extirpation. If this is done properly, there need be no question as to what the resultant scar contains. On the other hand, there is no means of knowing what is in the scar produced in an apparent cure by irradiation with radium or X-rays; and experience has shown frequent recurrences in such scars, from the growth of radioresistant portions of the epithelioma which the fibrosis produced by this treatment could only delay but not prevent.

Cancer growth is expansile and invasive. Expansile growth produces prominent tumor projections, with little tendency to involvement of the deeper tissues; while invasive types may present an inconspicuous surface and a considerable carrot-like extension into the depth. It is highly important, therefore, in the excision of epitheliomata of the skin, to cut through the tumor immediately after it has been removed, and to make certain that the line of excision in the depth has been as certainly wide of the epithelioma as has been the more easily visible lateral margin. If the deep line of the excision has been too close to the tumor, more of the deep tissue can and should be removed at once.

Basal-celled cancers of the skin have been known to produce lymph-node metastases in only a few instances. Squamous-celled cancers of the skin are known to metastasize to the nodes, but this occurrence is not a common experience, and is rarely observed at so early a time as it has been found in Doctor Kennedy's patient. It is not necessary, therefore, to remove the regional lymph-nodes as a routine procedure in cases of squamous-celled epithelioma of the skin of the face; but when such lymph-node metastases

seem, clinically, to have occurred, and particularly when this clinical finding is verified by microscopic examination, then a comprehensive lymph-node dissection becomes a matter of the greatest importance. There may be but one invaded lymph-node (a localization frequently noted in cancer cases), and this seems to have been the condition in Doctor Kennedy's patient, since he has remained well in spite of the limited excision; but when the cancerous node is large enough to be clinically recognizable as such, it is more than probable that a microscopic advance guard of cancer cells has proceeded to lymph-nodes further on in the chain. The lymph-nodes seem to be provided, regularly, with a by-pass channel, which is utilized especially when the intrinsic lymph-node channels are blocked. With the presence of cancer metastases in the lymph-nodes, therefore, it is important to remove not alone the invaded regional group completely, but also the nodes beyond these in the lymphatic stream, to the widest extent practicable.

The regional lymph-node distribution can usually be determined for any region by a study of the veins. The main lymphatic vessels regularly tend to accompany the larger venous trunks; and this close association is probably referable to a close relation between the lymphatic channels and the veins in their embryonic genesis from mesoblastic angioblasts. In Doctor Kennedy's patient, the regional lymphatic path has been first to the nodes upon the parotid in front of the ear. From this station, the further path is through the superficial chain about the external jugular vein, at the angle of the mandible, and finally into the deep chain via the carotid packet, about the jugular vein, at the level of the carotid bifurcation. In the case presented, the length of time that has elapsed since operation, without recurrence, seems to indicate that there was a fortunate localization of the metastases in a single node; but it would be unwise to conclude from this experience that a limited lymph-node extirpation is ever a safe procedure, or that this patient may not still have cancer latent in the remaining nodes.

Doctor Kennedy rejoined that he agreed entirely with Doctor Semken that the ideal method of treating a case of this kind was to do a block dissection of the cervical lymph nodes. In this case, however, since operation for the removal of the lymph node in the parotid region had disclosed the fact that metastasis had occurred only six weeks after the appearance of the original lesion, the case was regarded as so malignant that further operation would be hopeless.

MELANOCARCINOMA OF THE ARM

Dr. Robert H. Kennedy presented a woman, aged thirty-nine, who was admitted to the New York Skin and Cancer Hospital November 6, 1926. Her family history was negative for known cancer. Five years previous to admission she had noted a dark spot on the left upper arm the size of the head of a common pin. This had been growing steadily since. She had consulted no doctor until coming to the hospital clinic three weeks before admission. At that time the lesion was one and one-half centimetres in

diameter and bluish black in color. It was excised widely under local anæsthesia. The pathological report was melanocarcinoma.

When admitted her physical examination was entirely negative for evidence of any metastases. November 8, 1926, under colonic anæsthesia the axillary tissue was excised *en masse*, including the sheath of the lower portion of the axillary vein. She made an uncomplicated recovery and was discharged one week later.

Since that time she has been seen frequently at the follow-up clinic and no evidence of metastases has become evident. She has had no X-ray treatment. It is now over three years and four months since the lesion was excised and over eight years since the patient noted that it was growing.

MELANOCARCINOMA OF BUCCAL MUCOUS MEMBRANE AND UPPER AND LOWER LIPS

Doctor Kennedy presented a woman, aged forty-nine years, who was admitted to the New York Skin and Cancer Hospital October 1, 1927. Her family history was negative for known cancer. Fourteen years previously while undergoing dental treatment the right lower lip was pinched by an instrument. A "blood blister" followed immediately and a dark spot had remained at this site since. Two months before admission the dark area commenced to spread rapidly. She did not consult a physician until one week before admission. She had not lost weight.

Examination showed a bluish area on the mucous membrane of the right cheek extending back from the right angle of the mouth. This was raised about five millimetres and was ulcerated over an area three centimetres in diameter. The discoloration also extended onto the mucous membrane over the mandible involving up to the margin at one of the bicuspid teeth. The vermilion surface of the upper lip for one inch and of the lower lip for one and one-half inches from the right angle of the mouth was involved in the same bluish black discoloration. Small lymph nodes were palpable in the right submaxillary and carotid regions. The teeth were in poor condition.

While this lesion appeared to be melanocarcinoma, it was felt that with the long history, hæmangioma with pyogenic granuloma must be considered. The ulcerating lesion was therefore excised by actual cautery. The pathological report was melanocarcinoma.

In view of the site and extent of the lesion with the presence of cervical lymph nodes the case appeared inoperable. However, Dr. Franz Torek, who was in charge of the service, felt that the discomfort in the progress of such a lesion would be so great that an attempt at complete excision should be made. Consequently on October 12, 1927, under colonic anæsthesia the entire area was excised with the knife. This involved removal of almost one-half of the mouth opening and an oval extending back through the full thickness of the cheek for over five centimetres from the right corner of the lip. Mucous membrane and skin were brought together but no attempt was made to close the defect. The tissue removed at this operation showed only inflammatory changes. Fifteen days later, a strip of dark tissue one and one-half by one centimetre was removed from alongside the first lower right bicuspid, this having been missed previously. The pathologist reported melanotic cells present in this specimen also.

November 3, 1927, three weeks after the complete excision, a plastic operation was done, freeing the stump of the lower lip so that it could be anchored to the cheek. The upper and lower lips were not sutured together thus still leaving a considerable cheek defect. This gradually shrunk down to

its present condition. The only other operation was a swinging of a small flap of upper lip to improve the corner of the mouth. She was discharged from the hospital January 20, 1928, with a good functional mouth.

This patient has been seen frequently in the follow-up clinic and there is no evidence of recurrence nor metastasis. She has had no X-ray treatment. They have felt that it would be improper to open up the scar to improve the condition of the mouth or to remove the cervical lymph nodes while they showed no evidence of involvement. It is now two years and five months since operation.

The reporter added that surgeons are prone to consider melanotic lesions extremely malignant. A great many are highly malignant, but he did not believe that at present one could tell which ones. These two patients were shown to illustrate the prolonged course of some. A proper excision of a melanotic lesion never causes it to suddenly spread widely. The patient usually comes because a change has taken place in a preëxistent mole. Coincident with this activity, which probably means a change to cancer, metastases may have taken place and be microscopically present at the time the original lesion is excised, and go on to palpable metastases within a brief period. Not long since he had seen a patient who had had a too conservative excision of such a lesion on the sole of the foot three months previously. Over eight hundred metastases were counted in the skin and the X-ray showed one in the tibia, which was later proved at autopsy. Ewing states that some cases run an acute course proving fatal in a few weeks. In Kuttner's clinic thirty-nine cases of melanotic cancer were reported of which twenty-six were operated on. Four survived for five years, soon after which three died of generalized melanotic cancer. Some patients seem to present marked resistance to the progress of the disease, as Chauvin reports a woman whom he operated on four times in twenty-two years for such a lesion and Fye a case operated on three times in twenty years. Melanocarcinoma probably varies in its malignancy as much as any other type of cancer lesion.

Dr. Franz Torek remarked that melanotic tumors have one thing in common with all other malignant tumors; at some time they are localized and if they are seen at that time they can be just as successfully operated on as any other type of carcinoma. It is only when they have metastasized through the blood-stream that nothing can be done. Every surgeon is familiar with the experience of cutting out a melanotic tumor with a wide margin around the external appearance and of finding, as he goes into its depths, black spots extending some distance from the surface. If there were some way of knowing this beforehand one would not operate on such a tumor. Metastasis through the lymph-stream, however, does not contraindicate a surgical removal; the speaker had removed one fifteen years ago from the thigh of a patient in whom extensive black lymph nodes could be seen in the groin, and the man has remained well to the present time. As to the possibility of closing this large cheek defect without a flap plastic, formerly, Doctor Torek always planned the encouragement of new growth by flap plastic in large cheek defects, but in a case in which the growth

had been removed by cautery the cheek shrank so quickly that by the time it was possible to do the plastic, the defect was so small that a plastic was unnecessary.

DR. CONDICT W. CUTLER, JR., said that there may be manifested different degrees of malignancy of these tumors in different patients, as well as varying degrees in the same patient at different times. As illustration of this he cited a case on which he operated three years ago for swollen inguinal lymph nodes, which proved to be melanocarcinomatous. The only fact in the history which the patient gave which was relevant was that she had had a small, black wart removed from the vulva twelve years previously with no local recurrence. Two months after the radical excision of the inguinal and femoral lymph nodes there was a local recurrence, which was again removed. The patient subsequently complained of headaches and vomiting, began to vomit blood and died in a few weeks. Autopsy showed widely disseminated metastases throughout the body, involving the brain, and an isolated metastasis in the wall of the stomach which was ulcerated and which was responsible for the vomiting. Apparently it is possible for a growth of this type to be relatively non-malignant and go for a long time without showing the lymphatic metastasis which one would reasonably expect.

PAGET'S DISEASE OF THE VULVA

DOCTOR KENNEDY presented a woman, aged sixty-three years, who was admitted to the New York Skin and Cancer Hospital, November 20, 1929. She knew of no cancer in her family. For the past year she had had an irritation of the right side of the vulva without discharge or bleeding. During this time she had been under a physician's care and treated by various salves. Examination showed a lesion about the middle of the right vulva 3 by 2 centimetres and about 2 centimetres distant from the muco-cutaneous junction. This was raised, reddish-gray in color, a glazed surface, a suggestion of a pearly border, definite margin and seemed fairly superficial. No inguinal nor femoral nodes were palpable. The provisional diagnosis was epithelioma. The growth was excised under local anæsthesia, including a margin of normal skin 2 centimetres wide on all sides and carried to a depth of the muscle beneath. On cutting through the section it appeared grossly to extend little, if any, through the basement membrane. The patient made an uncomplicated recovery. The pathological report was Paget's disease of the vulva. Thickened epidermis with changes in the cells resembling Paget's disease, *i.e.*, dyskeratosis and hyperchromatism with mitoses. It is now about four months since operation, and patient shows no local recurrence nor evidence of metastases.

This patient presents an uncommon type of lesion, although it is a question whether Paget's disease should be considered a clinical entity. The majority believe at the present day that the lesion is early cancer but views vary as to the origin of the Paget cells. These are recognized by their size, being usually larger than that of a normal prickle cell, their clear cytoplasm and the small deep-staining nuclei. He had been able to find thirty-five cases of extra-mammary Paget's disease reported in the literature. Five of these were on the vulva, and none seem to have been connected with deep-seated cancer, as is generally believed to be the case with Paget's disease of the nipple. The essential clinical features as given by Kilgore are, (*a*)

epidermal hypertrophy—in affected area two or three times normal thickness; sharply marked off at edge of lesion; (*b*) subepidermal round-cell infiltration; (*c*) so-called "Paget's cells," as described above. Fraser has the most recent article referring to this disease in the *New York State Journal of Medicine* of January 1, 1930. He believes that the cases of extra-mammary Paget's disease are usually intradermal tumors arising from the sweat ducts. Crocker, Rolleston and Hunt, and Sekiguchi had previously described extra-mammary Paget's disease as a primary carcinoma of the sweat ducts or sweat glands. From the site and appearance of this lesion it would conform well to this idea. In other words one is dealing not with a benign lesion, a precancerous lesion nor a secondary implantation, but with a primary carcinoma.

Dr. George H. Semken said that the desirability of burdening the name of Paget with a third disease is open to serious questioning. The two diseases already so named (Paget's cancer of the breast and Paget's disease of the bones) are troublesome enough. It is questionable also, whether a separate name need be given to one type of squamous-cell cancer of the vulva. The squamous cell may undergo many changes in metaplasia, from the anaplastic type of cancer of the pharynx to the fully differentiated adult type of cell characteristic of many squamous-celled cancers; but these are differences in degree and not in kind. The essential fact is that cancers of the vulva are squamous-celled cancers with a potential power to produce metastases soon or later in the regional lymph-nodes. The types that are expansile in their manner of growth and tend to invade the epidermal layer alone may remain localized for long periods; but eventually, they will break through the basement membrane and invade the deeper tissues, and metastases will occur. Such metastases may remain latent for long periods and it is not uncommon to find cancer in the regional inguinal nodes many months or even a few years after the removal of a small lesion from the vulva, which seemed to have little importance at the time of its removal.

Two antecedent histological conditions may have a bearing on subsequent cancer of the vulva. The one, kraurosis, is apparently a trophic condition, characterized by a loss of the glandular and elastic elements, a lessening of the vascular supply and a general atrophy. The epithelium becomes thin and shows no tendency to active proliferation. As a consequence of the trophic changes, small fissures and inflammatory processes occur, from which will result foci of round-cell infiltration and fibrosis. The subsequent cancerous proliferation thus seems due to a secondary irritative process (in a susceptible individual). The second antecedent condition, leucokeratosis, is a frank epithelial hyperplasia from the start and tends to become an invasive process also, under suitable conditions.

In judging the extent of the regional lymph-node distribution for cancer of the vulva, the knowledge gained from the injection of dye-stuffs (Gerota) may be supplemented by the experience of the distribution of the syphilitic inguinal lymph-nodes associated with unilateral initial lesions of the vulva. This lymph-node invasion is uniformly bilateral. It would thus seem logical, in planning operations for cancer of the vulva, to include in the cancer field

(actual and potential), the inguinal lymph-node groups of both sides. On the side of the primary cancer, the lymph-node dissection is carried high into the femoral canal. When cancer has invaded the inguinal nodes to an extent clinically recognizable, the dissection should include the lower nodes of the external iliac group also, access to this field being obtained by dividing the inguinal (Poupart's) ligament.

In the case presented by Doctor Kennedy, an apparently sufficient time has elapsed to indicate an absence of metastasis; but he should feel, nevertheless, that it would be safer (not to say wiser) to remove the regional nodes at least from the tumor side, even at this late date.

TUMOR OF THE SPINAL CORD

Dr. Byron Stookey presented a woman, thirty-eight years old, who had been operated on in 1924 for an extradural spinal cord tumor lying between the second and third thoracic vertebræ on the right side, entirely extradural with a projection which extended forward between the first and second thoracic vertebræ. The spinal cord and dura were pushed sharply to the left. The tumor was encapsulated and was removed. The dura was not opened due to the fact that there was no involvement of the dura. The histological report showed a fibrosarcoma. The patient made a rather slow but an incomplete recovery.

In October, 1925, nine months after her discharge, she was re-admitted with a local recurrence of the extradural fibrosarcoma. At operation digital examination of the dura showed a slight unevenness within and the dura was therefore opened. A fusiform tumor approximately 4 by 1¼ by 1 centimetre was found, entirely free and unattached to the dura and in no wise related to the extradural tumor. The tumor was beneath the arachnoid, was readily removed and appeared to be a glioma. The patient made an uneventful recovery and is now able to do her housework and is entirely well, four and a half years after the operation. X-ray therapy has been given to prevent recurrence of the extradural fibrosarcoma.

When a purely extradural tumor is found without any involvement of the dura the usual procedure is not to open the dura. He presented this patient because of the extreme rarity of finding two tumors of different tissues without any anatomical relation or connection.

FACIAL-HYPOGLOSSAL NERVE CROSSING

Doctor Stookey presented a patient who was operated in 1923 by him at the Post Graduate Hospital for facial nerve paralysis which developed after mastoidectomy. A facial-hypoglossal nerve crossing was done, suturing the distal end of the facial to the proximal end of the hypoglossal and the distal end of the hypoglossal to the proximal end of the descendens hypoglossei.

Volitional control of the facial muscles has returned so that the marked facial asymmetry is now improved so that the face at rest is essentially equal to that of the normal side. The patient is able to move the angle of the mouth and close the eye but is unable to elevate the eyebrow. Emotional responses still show considerable asymmetry but reflex winking has been reëstablished.

Doctor Stookey pointed out that facial-hypoglossal nerve crossing is preferable to facial-spinal accessory nerve crossing since the reflex connections of the facial and hypoglossal nerves are more closely related than the

spinal portions of the accessory nerves which have no reflex connections in common.

DIFFERENTIAL SECTION OF TRIGEMINAL ROOT FOR NEURALGIA

DOCTOR STOOKEY presented a patient who had trigeminal neuralgia with primary involvement of the mandibular division, in whom a differential dorsal root section was done in which the sensory fibres of the dorsal root were sectioned without section of the motor fibres or the maxillary or the ophthalmic fibres. Anæsthesia was limited to the distribution of the mandibular division with retention of the corneal reflex and intact motor innervation to the muscles of mastication.

Differential section of the trigeminal dorsal root is the procedure of choice in the treatment of trigeminal neuralgia.

CHOLESTEATOMA

DOCTOR STOOKEY presented a woman who was admitted to the Neurological Institute January 3, 1924, complaining of headache, which she had for four years, bad memory, dizziness, failing vision, vomiting and drowsiness. In 1919 for a period of two weeks she remembered distinctly seeing double. Otherwise she had been well. In 1920 she noticed for the first time mild, brief headaches, frontal in type, which occurred about twice a week and which continued until 1922. At one time when she was in the country she noticed a sudden change in her vision. Over night she became nearly blind, the headaches became more severe and she was forced to remain in bed for two days. After that her vision improved but has never been good. Shortly after this she began to have dizzy spells when she had to lie down in order to recover.

In about 1922 her memory began to fail her, she became forgetful, misused words and could not read, claiming that she could not understand what was written. In writing she was also apt to use wrong words. This symptom became progressively worse.

Physical examination in January, 1924, showed gait and coördination to be entirely normal with the exception of a slight tremor in the right hand. Skilled acts were well done. Patient showed an inability to name objects but recognized them and knew their use. There was a marked increase of reflexes on both sides with slight inequality of the abdominals, those of the right side being greater than the left. Fanning was present on the right. Bilateral ankle clonus but no Babinski was found. There was no motor weakness and no spasticity. General sensory examination was entirely negative. The fields, roughly tested, showed marked contraction. The patient was unable to read some printed words but could recognize and name some of the letters. The discs were slightly indistinct, the borders were hazy with some pallor but no swelling.

The X-rays showed evidence of increased intracranial pressure without localization.

January 16, 1924, after raising a bone flap, a ventricle puncture was made. The dura was under pressure. When the ventricle was punctured, the cerebrospinal fluid flowed out drop by drop. Nine cubic centimetres of cerebrospinal fluid were withdrawn and eight cubic centimetres of air introduced. Three days later a needle was inserted in various directions but no resistance was met. Because of the marked tension and inability to reach the ventricle it was deemed unwise to open the dura.

After the patient's discharge she seemed much improved. Her headaches

were better, memory improved but she was very nervous and slept excessively.

Examination in 1926 showed the patient's gait to be normal. She could not swing her right arm. There was very slight awkwardness in the finger to nose test on the right and also in the finger to finger and in the toe to object and heel to knee tests. There was a definite aphasia and anomia. The reflexes were exaggerated, fanning was present on the right but not on the left. Plantar flexion was present on both sides. There was slight spasticity on the right side but none on the left. Abdominals were equal. There was no stereognosis and all sensory findings were normal. Cranial nerves showed a right homonymous hemianopsia with temporal halves of the discs pale. All the other cranial nerves were normal.

December 7, 1926, an attempt was made again to puncture the ventricle and inject air. This was done through one opening of the old osteoplastic flap, using a trigeminal needle which was inserted at a depth of 2 centimetres and a slightly cloudy fluid came out similar to that which was previously withdrawn. It was not considered to be cerebrospinal fluid. Unfortunately the fluid was not centrifuged and studied or the diagnosis would have been made. Ten cubic centimetres of fluid were withdrawn and approximately ten cubic centimetres of air injected and ventriculograms taken. The last two cubic centimetres of fluid removed were crystal clear although the previous eight cubic centimetres were cloudy.

Ventriculograms showed what was apparently a walled-off collection of air on the surface, apparently extracerebral. The conclusion reached was that there was a collection of fluid on the surface, similar to those described by Horax in the posterior fossa which simulated cerebellar tumors—in this case a collection of fluid in the temporal fossa simulating temporal lobe tumor.

At the second operation the old bone flap was re-opened. Just beneath the cortex of the temporal lobe a large cheesy mass was encountered which extended from the region of the mastoid forward beneath the temporal lobe, pushing into the frontal and parietal lobe extending toward the mid-line. When the epidermoid material was finally removed it had occupied an area approximately the size of one's fist. It had a definite capsule and had not eroded the brain at any point. However, the capsule was so soft and friable that removal was impossible. All of the cheesy material was removed, leaving a smooth glistening capsule. This was thoroughly cauterized with Zencker's solution. The tumor mass extended forward underneath the frontal lobe and pushed over the temporal and parietal lobes. The tentorium was exposed behind, the under surface of the temporal lobe and the anterior fossa forward. The dura was closed and the flap replaced.

This has been an extremely instructive case. The patient showed very little progress during the three years between the first and second operations. The problem presented after X-ray therapy was whether the presumed arrest of the growth was due to X-ray or not. Another interesting feature was that a needle inserted through presumably brain tissue may pass through a soft tumor without indicating any resistance; consequently, the absence of resistance to the needle can be met with in the presence of a soft tumor. The third point is that even after the dura is exposed and normal cortex is seen, it does not necessarily follow that the presumed cortex showing through is normal since a whitish-grayish tumor mass such as a dermoid may be present and appear as if it were normal cortex. The dura should always be opened and the wound thoroughly explored.

The patient was discharged January 10, 1927, much improved. There

was essentially no change in so far as aphasia was concerned but the homonymous hemianopsia disappeared.

In the follow-up clinic in May, 1926, the patient was said to have made complete recovery. Her only complaint was forgetfulness. She showed a very slight right hyperreflexia but no pathological reflexes were present. The fundi were normal and the operative area showed no bulging, with the wound well healed. Again in March, 1930, the patient came to the follow-up clinic. Except for occasional headaches and some irritability and anomia the patient seemed well. Muscle joint and tendon sense were normal. Two-point test was normal and touch localization was normal. Cranial nerves were normal.

Dr. Ira Cohen said with reference to Doctor Stookey's blaming himself for not having opened the dura at his first operation in his spinal cord tumor case, he did not feel that anyone else would do so. Personally, he felt, that he would have been so relieved to discover the extradural tumor that it would not have occurred to him to look further. Referring to the history of a positive block, the speaker doubted if much stress could be laid on this after a previous laminectomy, because the tumor causes sufficient pressure together with the laminectomy to produce enough adhesions to give block.

Dr. Irving H. Pardee (by invitation) said that he thought Doctor Stookey had demonstrated the importance of accurate localized diagnosis in these cases and he considered that the case of spinal cord tumor was a striking illustration of this. Charles A. Elsberg, in his book on spinal cord tumors, has stated that he has frequently seen spinal cord tumor in a patient in which one symptom will present itself at a lower bowel and be operated for, no tumor being found; the patient will continue to present symptoms which are later traced to a tumor at a higher level where it would have been found had not the first symptoms led them astray. It is now possible to avoid such errors because the demonstration of a block in the spinal fluid is an indication of a tumor located above such block. Doctor Pardee commented on the fact that through the work of such men as Doctor Stookey and Doctor Frasier, section of the trigeminal root has become a simple procedure. While formerly attended with a high mortality, at the present time death seldom ensues. The operation has become as simple as a laparotomy; it is done under local anæsthesia with the patient sitting in a chair so that there is no danger of bleeding obstructing the field. Differential root section makes it possible to avoid the distressing eye complications which were the result of complete section. As far as intracranial operations are concerned, here is a more serious problem. Laminectomy is readily done and the trigeminal patient is up and about in a few days. The operation of craniotomy is not so serious as is the fact that many of the intracranial tumors are not on the surface but are deeply seated which makes the hazards much greater and results not nearly so satisfactory. Doctor Pardee said he had been deeply impressed with Doctor Stookey's case of suture of the hypoglossal and facial nerve for nothing is more distressing to a person than to have facial paralysis and if by the use of this

operation a fair degree of motion is regained, it is very gratifying and pleasing to be able to accomplish that in these cases.

PULSATING EXOPHTHALMOS

Dr. John M. Hanford read a paper with the above title for which see page 88.

Dr. John M. Wheeler (by invitation) said that most of the diagnoses of this condition have been made by ophthalmologists and the treatment has fallen between ophthalmology and surgery. All surgeons who operate on the neck should give this some study because it is important. It might also we well to practise listening for bruit in fractures of the skull, especially basal fractures. Doctor Hanford had spoken of spontaneous cases but had not emphasized them. Not all the cases are traumatic; the speaker had reported three cases of spontaneous origin, one a man with lues admitted to Bellevue Hospital with non-pulsating exophthalmos on one side and later on a pulsating exophthalmos on the other side. Doctor Burdick operated on him with success. The matter of pulsation of the eye is not of great importance in making a diagnosis although this condition is called pulsating exophthalmos. Simply feeling the globe will not necessarily establish pulsation; the proper way is to press the eye back in its orbit and this will bring out the pulsation beneath the closed lids. Doctor Hanford referred to suturing the eyelids together. The chief dangers to the eye are from hæmorrhagic glaucoma, and loss of vision and probable loss of the eye through injury to the cornea through exposure. Consequently, ordinarily the lids should be held together for resistance to the progressive condition of the exophthalmos and for the protection of the cornea. This requires a refinement of technic so that adhesions can be made which will stay as long as one wishes.

Dr. Daniel B. Kirby (by invitation) said that the part he played in the treatment of this case had been in attempting to relieve the glaucoma. The rise of intra-ocular pressure came from obstruction of the venous system of the eye. In all cases of thrombosis of the central retinal vein, glaucoma is likely to develop and is carefully watched for. In this case, there was interference not only with the central retinal vein, but with all the venous system. The widespread œdema and hæmorrhage blocked the exit of fluids passing from the eye, particularly from Schlemm's canal which has a direct communication with a vein. When it was found that the patient's vision was gone and that the eye was the source of great pain through uncontrollable glaucoma, conservative measures having failed to relieve the tension, there was no other recourse but to enucleate the eye and this was accomplished under local anæsthesia. In regard to the enophthalmos, Doctor Kirby thought Doctor Hanford right in assuming that there had been absorption of orbital fat due to faulty nutrition. In many cases where enucleation is indicated, an implant of various substances is used to replace the globe. This does away with much of the sinking. In this case,

due to her grave condition at the time of the operation, it was not advisable to use the implant. Now that she has recovered, the implantation and plastic repair may be used as an operation of choice. Doctor Kirby said he had reported a case, seven years ago, of a man sixty-four years of age who, thirty-four years previously, had suffered a severe fall and injury to the head. After recovery there was ptosis of the lid on the right side and evidence of injury to the right third, fourth, fifth, sixth, cranial nerves, evidently a lesion in the right middle cranial fossa. The patient died of bronchopneumonia complicating a primary anæmia. Post-mortem examination disclosed a large aneurism 4 by 5 centimetres of the internal carotid artery that had healed by laminated clotting. This case was particularly interesting because it demonstrated that these lesions may heal spontaneously.

Dr. George H. Semken said that several years ago, Dr. Lewellys F. Barker, in an address in the New York Academy of Medicine, emphasized the greater effectiveness of ligation of the internal carotid artery over that of the common carotid in cases of pulsating exophthalmos. He showed the slides of a patient in whom a marked protrusion and pulsation were present. The ligation of the common carotid was effective for about fifteen minutes only, then the pulsation and protrusion reappeared; but both were successfully overcome by an immediate ligation of the internal carotid.

When the common carotid artery is ligated, (1) the immediate collateral circulation comes through the two vertebral arteries and the common carotid artery of the opposite side, by way of the circle of Willis. (2) Soon, however, there is an additional collateral circulation via the external carotid, which has a rich system of communication with its fellow of the opposite side, and (by way of the superior thyroid) with the inferior thyroid branch of the thyrocervical trunk from the subclavian. This collateral supply enters the internal carotid at the bifurcation. (3) In addition to this, there is a further collateral supply via the anastomosing branches of the internal and external carotids. The large amount of blood that enters the internal carotid artery in this way, in the absence of occluding disease in the blood-vessels, tends to reëstablish the high pressure in the internal carotid aneurism, and the objective of the common carotid ligation is not attained.

Since the aneurism is wholly in the territory of the internal carotid, it would seem logical to ligate the internal carotid alone, thereby attacking the main supply vessel directly, minimizing the chance of a major collateral blood supply, and restricting the extent of vascular interference to the minimum. In a patient with pulsating exophthalmos, in whose case I had the opportunity of ligating the internal carotid of the affected side nearly five years ago, there was an immediate cessation of the bruit, a progressive recession of the protrusion and a complete clinical recovery within ten days. This case had been classical and well marked. There had been the history of trauma, a fairly sudden onset of symptoms beginning with engorgement of the blood-vessels of the eyeball, then progressive exophthalmos, and a loud

bruit over the eye, transmitted down the cheek and down the neck, and audible also over both mastoid processes. The veins of the upper lid were distended only when the patient lay in the recumbent posture. There has been no return of any of his symptoms. This experience is in harmony with the favorable results reported in Doctor Hanford's paper for the ligation of the internal carotid.

The ligation of the common carotid has an operative mortality of thirty per cent.; the ill effects being probably due to associated occlusive vascular disease. When the bifurcation of the carotid has been injured in operations for advanced cancer of the neck, it has been necessary to ligate the common carotid, the internal and the external carotid in order to control the bleeding.

In such instances (usually older people), the patients do not regain consciousness and die with the characteristic symptoms of hemiplegia. It is thus evident that the circle of Willis cannot be depended upon alone to maintain the cranial circulation in such circumstances; and that the additional collateral supply between anastomosing vessels of the internal and external carotids is indispensable. This takes place chiefly in two groups—one, the anastomosis of the ophthalmic artery with the angular and the temporal arteries, and the other, the anastomosis of the anterior meningeal branch of the internal carotid with the middle meningeal branch of the internal maxillary artery. These sources of a collateral supply are wholly conserved if the common and the external carotid are undisturbed.

It has been advised, in cases of common or of internal carotid ligation, that the internal jugular vein be ligated at the same time, to prevent too great a lowering of the intracranial blood volume. This has a theoretical merit from a purely physiological point of view, but it would seem objectionable in the cases of intracranial carotid aneurism, where such lowered blood volume and pressure are the objectives sought. It is probably wiser to ligate the internal carotid artery alone, leaving the vein undisturbed.

The technic of ligation of the internal carotid is simple; but as described in the surgical textbooks, it may prove troublesome. The advice usually given is to proceed along the anterior border of the sternocleidomastoid muscle. This carries the dissection into a field of fat, lymphatics and small veins. A more convenient approach may be obtained as follows:

The usual transverse or slightly oblique incision is made with its midpoint over the vessels at a level between the hyoid bone and the upper border of the thyroid cartilage of the larynx. This is deepened through the subcutaneous fat and the platysma. A longitudinal incision is then made in the sheath of the sternocleidomastoid muscle about one-half inch behind the anterior border of the muscle and parallel with it. The muscle is dissected free from the anterior part of the sheath and is retracted, leaving the deep surface of the muscle-sheath as the floor of the wound. Thus, only a single layer of the middle cervical fascia remains as the covering of the great vessels. This fascia is incised longitudinally and the internal jugular vein is recognized, with the thin sheath covering characteristic at this level.

At the anterior border of the internal jugular vein, in this field, a large branch vein is then found—the common trunk of the ranine and the common facial veins. The bifurcation of the carotid usually lies immediately above or below the level of this branch vein, directly anterior to the internal jugular. The space above the branch vein contains fat and some small veins which may prove troublesome. It is preferable, therefore, to approach the bifurcation via the space below the vein junction unless it can be determined that the bifurcation has an unusually high position. Light incision of the fascia then brings the carotid into view; and the necessary extent of exposure is obtained with blunt retractors of Little's type. The relative position of the external and the internal carotid at the bifurcation is respectively anterior and posterior; and they present, with the birfurcation, the appearance of an inverted pair of trousers; but the internal or "posterior" carotid is somewhat larger than the external. The fascial sheath about the arteries is now lightly incised, the opening is lengthened bluntly with a grooved director, and, with the same instrument, the space between the external and internal carotids is cleared. The ligature of chromic catgut No. 0 is then passed around the internal carotid within its sheath and from behind forward. The internal jugular vein is avoided in this way, and there is no likelihood of including the vagus in the ligature because it lies still further posteriorly, beneath the outer edge of the internal jugular vein. The small "shoe buttoner" type of ligature carrier is advised because there is not sufficient space for the safe use of a Deschamp's carrier. Emphasis must be placed upon the need of care in giving the ligature-carrier its final gentle push around the vessel. It is advanced by a gentle side-to-side motion, which opens the periarterial areolar space. At the end, the instrument should not be pushed forward unless the steel tip of the carrier is clearly visible as such. It has happened that part of the arterial wall, stretched thin, has been carried along on the tip of the instrument, and the final thrust then pushed the tip through the vessel wall.

In the ligation of the internal carotid, other technical points also are of interest. John Collins Warren, in his "Surgical Pathology" showed that after the ligation of a large artery, a partial restoration of continuity in the arterial stream had been established by the development of a collateral vessel that formed a by-pass around the ligated site.

This possibility is obviated by ligating the artery in two places, a few centimetres apart. It is not advisable to divide the artery between these ligatures, since the space is not long enough to provide adequate and safe stumps and the vessel might be pulled away from either ligature. The uncut artery will hold both ligatures well and will also limit the extent of motion possible to each ligature site. It is unwise, however, to leave the vessel segment between the ligatures as a completely closed space in which fluid might collect or in which inflammatory processes might arise that could lead eventually to an ascending thrombosis; so this segment is cut with the scissors through a part of its circumference. Finally, in order to avoid

producing a sudden change in the related intracranial circulation, the first ligature should be tied slowly, with the allowance of a proper interval between the successive stages of the occlusion for the collateral circulation to be established.

STATED MEETING HELD MARCH 26, 1930

The Vice-President, Dr. John Douglas, in the Chair

BOWEL CARCINOMA

Dr. Winfield Scott Schley presented seven cases of bowel carcinoma, treated from two to sixteen years ago respectively. They were presented because of the variations of technic employed, two- and three-stage operations having been done, which Doctor Schley believed had placed them in better position for a wide removal of the disease, especially as most of the growths were below the transverse colon, and also because he believed it often wiser to establish a permanent colostomy or sigmoidostomy than to risk viability of the gut in stretching for an anastomosis or trying to create a perineal anus.

Case I—*Carcinoma of Rectum.* Woman, thirty-seven years of age, was admitted to St. Luke's Hospital December 27, 1924, with a history of bloody diarrhœa with heavy bearing down pains in rectum for six months previously. She had had as many as twelve to fifteen stools a day. On two occasions the blood loss had been considerable. Notwithstanding, she had lost but little weight. She had menstruated regularly. Previous history negative. Parents living and well. Occupation stenographer. She was a rather poorly developed and nourished young woman of fair color. Superficial glands negative. Rest of physical negative with exception of rectum, which showed multiple larger and smaller fairly firm, nodular masses, extending from two centimetres above the sphincter as far as the finger could reach. The larger masses were upon the right lateral wall and anteriorly. They bled easily on palpation. They could be felt through the recto-vaginal septum. Biopsy specimen taken before admission showed carcinoma.

Five days after admission, following 500 cubic centimetres blood transfusion, colostomy was done upon the left side. No palpable glands or intra-abdominal involvement was apparent. The growth had not reached the sigmoid. Three weeks later, excision of the rectum was done by the following technic: With the patient in the lithotomy position, the posterior vaginal wall was incised in the mid-line and incision carried down through perineum and around the sphincter which had been tamponed, painted with iodine and closed with clamps. The incision was then carried down to coccyx. Wide retraction was possible. The vaginal wall was easily reflected and apparently uninvolved. By traction on rectum, it was possible to work widely on the bowel, removing all fat and loose tissue to well above the levators and finally opening Douglas' pouch; after further careful exploration the gut was divided by cautery six centimetres above palpable growth. Peritoneum was closed and the end of the bowel was implanted into the upper part of the vagina. The posterior vaginal wall closed with chromic sutures and perineum with silkworm retention sutures. A tube and gauze drain extended up to gut and were brought out through perineum. Patient stood the one-hour-and-fifty-minute operation well.

Post operatively the drainage was very moderate. Highest temperature

101°, with a pulse of 98 on third day. Perineal sutures removed in twelfth day. Drainage tube removed the seventh day. Vaginal douching started fourteenth day and douche returns were at first cloudy and contained mucus, but soon cleared up. Convalescence very uneventful.

Examination of rectum revealed multiple irregular masses, one nine centimetres in length and surrounding the wall except for one centimetre. The fascia at the upper end of the tumor contained three small nodes. Microscopically, the tumor was an adenocarcinoma with infiltration of the muscular coats. Subserosa apparently not invaded nor were the lymph nodes.

It was considered impossible to restore a natural anus at the time as vitiating a wide removal of tumor and greatly jeopardizing the patient's chance of recovery. The colostomy has functioned perfectly and the vaginal mucous discharge is almost nil. She is able to do her daily work perfectly and has remained apparently well for over five years.

It seems noteworthy that a rather rapidly growing and extensive malignancy, in a comparatively young woman, should not have shown greater infiltration and lymphatic involvement.

The two-stage operation without attempt to restore perineal anus contributed much to her recovery.

CASE II.—*Carcinoma of Recto-Sigmoid.* A man, forty-six years of age, well developed and quite well nourished, entered the hospital February 4, 1914, with acute obstruction and marked tympanites which had existed for two days. A history of growing constipation with cramplike pains for the past six months, bowels sometimes remaining closed for a week at a time, and moving with dark blood content, suggested malignant constriction. Rectal examination negative.

Median exploratory the same day showed an annular growth at the recto-sigmoid junction of five or six centimetres in extent. No glands were apparent or palpable and the liver appeared free of metastases. A left-sided colostomy was done the same day. Three weeks later the growth was resected with all of the mesentery and some six inches of uninvolved gut. End-to-end suture was done. A tube previously passed through to rectum was used by traction to invaginate the upper an inch into lower half and held by chromic sutures interrupted—a rubber dam cigarette type drain inserted to line of union. Except for slight leakage on the third day, which lasted for a week only, convalescense was uninterrupted. Highest temperature 101 1-5 with a pulse of 82.

Examination showed an annular constricting neoplasm reducing gut lumen to four millimetres. The growth had actively invaded and extended entirely through the gut wall and the small glands in the meso-colon were invaded. Surface of tumor presenting in gut showed marked necrosis and ulceration. Type, Adenocarcinoma. No gelatinous changes. Colostomy closure done by clamps.

The patient was fortunate in having an obstruction call attention to his carcinoma before inoperability occurred.

The two- or three-stage operation in the presence of obstruction still seems to me desirable. A wide removal of gut and mesentery was done. The patient remains well over sixteen years following operation.

CASE III.—*Carcinoma of Recto-Sigmoid.* A stout woman of fifty-six years of age, admitted August 21, 1922, for some months had been having cramping pains and distension with expulsion of large amounts of gas by mouth and rectum following these attacks. Cathartics and enemas would bring away hard fæcal material.

On entrance, obstruction was subacute with tympanites.

In view of the increasing constipation with tympanites, a diagnosis of malignant growth obstruction of the large gut, sigmoid or recto-sigmoid, was made. Rectal examination revealed nothing.

Five days later, median incision under gas-oxygen showed recto-sigmoid growth and a *left side colostomy was done.* Mesentery, glands and liver appeared free.

Four weeks later, wide resection with removal of mesentery was done. Anastomosis, because of extreme fat, difficulty and danger in mobilizing gut and general condition of patient, was not done at this time. Rectal end of sigmoid closed and proximal end left open in colostomy wound, its upper opening preventing exclusion. Rubber dam cigarette drain to pelvis.

Examination showed an extensive adenocarcinoma of the recto-sigmoid narrowing and infiltrating gut, with a polypoid tumor additionally obstructing the lumen. Submucosa and muscle invaded but mesenteric nodes not.

This patient, after leaving hospital, showed marked arterial hypertension, blood-pressure of 240/260, traces of albumin and sugar and was not considered a good risk for further operation to anastomose the bowel. She has gone on seven and one-half years with her colostomy very satisfactorily.

Some six months ago apparent recurrence had taken place in the blind sigmoid end, but after washing out hardened fæcal matter, bleeding ceased and she has been well since.

The operation may be considered incomplete but the patient has done well with her colostomy which does not seem a heavy price to pay for her recovery.

Case IV.—*Carcinoma of Cæcum.* A poorly nourished anæmic man of fifty-six years of age was admitted to the hospital January 31, 1918, having lost nearly forty pounds in weight in the last year. His chief complaints: Loss of strength and weight with the presence of a large movable mass in the right lower quadrant of the abdomen. There was a marked anæmia. Patient said he had not noticed blood in stools and had had no diarrhœa. He was given blood transfusion and a two-stage operation was done: First an ileo-colonic anastomosis between the lower ileum and the transverse colon. Second, three weeks later with the patient in greatly improved condition, a removal of the lower ileum, its mesentery and glands, the cæcum and ascending colon up to hepatic flexure.

Pathological examination revealed a large cauliflower mass eight by seven centimetres within the cæcum almost obliterating the lumen. The lymph nodes along the terminal ileum were much enlarged and were involved. The appendix, twelve by one and one-half centimetres, showed beginning involvement.

Diagnosis.—Gelatinous carcinoma of the cæcum.

The convalescence was smooth and progressive, highest temperature 102 1-5 with pulse of 110 the day after the second operation.

The two-stage operation was the deciding factor in this man's recovery, permitting more radical and less complicated work in the second stage. He has remained well for twelve years.

Case V.—*Inoperable Carcinoma of Rectum.* A well-developed and still well-nourished man, moderately anæmic, who had lost some thirty pounds in weight and suffered for three months with bloody stools and passing blood from rectum with very constant desire to defecate, was admitted to the hospital September 16, 1927. Examination showed extensive masses with complete annular narrowing four centimetres above sphincter and extending up to eight to ten centimetres above sphincter. Considerable fixation was present with apparent infiltration of prostate and bladder fascia.

A colostomy through right rectus, which was expected to be permanent, was done. Biopsy showed adenocarcinoma of rectum. This man was examined by several members of the staff, who concurred in the opinion of inoperability. Accordingly he was subjected to radium treatment—using 100 to 150 milligrams radium element made up as application extending full length of growth. Many shorter treatments were given, rather than massive or large doses. Treatments were given at intervals over a period of several months. Improvement was continuous. This man has since had three proctoscopic examinations under general anæsthesia, showing the disease apparently cured. Mucous membrane smooth, glazed in appearance, yellowish pink in color.

A year and one-half after his first treatment he begged a closure of his colostomy as he feared he would be unable to work with it. X-ray examinations of chest, abdomen and bones were negative for metastases. Closure was therefore done with misgivings. He has remained apparently well. The last proctoscopic was done February 4 of this year. Other than large calibre stricturing from the fibrosis, with the mentioned changes in mucosa, nothing was to be seen.

This patient is not presented as cured as the time is still short for such assertion. That such an extensive growth should have shown the disappearance it has is, however, noteworthy.

Cessation of pain and bleeding is of frequent note in radiation treatment with prolongation of life even for several years. Ray sensitive growths may be cured. His treatment started October 26, 1927.

November 21.—Bleeding ceased and a gain in weight and color was very noticeable.

December 12.—Masses considerably reduced; more movable.

January 12.—Marked improvement, masses nearly flat, prostatic and bladder areas now the worst.

March 7.—Patient looked even ruddy. Rectal masses small, flat and firm. No treatment since May 16, 1928. He had a total of 2650 miligrams hours in thirteen treatments.

Case VI.—*Gangrenous Diverticulum of Rectum and Sigmoid.* A stout, acutely ill woman of forty-seven years of age, with abdominal distention and rigidity of left lower quadrant and mid-line below umbilicus, was admitted to the hospital May 26, 1916. Pain had begun over lower abdomen three days before admission and was made worse by castor oil taken the morning of admission when she was nauseated and vomited for the first time. There had been no diarrhœa or excess mucus noticed in movements. A sense of discomfort in lower abdomen preceded the attack. Frequent urination without hæmaturia was present. No blood had been passed by rectum. She had had a similar and a milder attack several months before with fever. Digital, rectal and vaginal examinations were painful higher up with sense of mass. Patient had menstruated a week before.

Operation second day after admission showed perforation of a diverticulum of the sigmoid just above the rectum into its mesentery with marked inflammatory reaction of all coats of gut and mesentery. Lower sigmoid and upper rectum gangrenous for three to four inches with free pus in pelvis. The condition of the gut, it was felt, forced resection upon us with the risk of opening up fascial planes. The sigmoid was cut across with cautery well above the involvement and gangrenous sigmoid and rectum resected with mesentery. *Distal end* closed by double chromic gut inversion and proximal end brought out as colostomy through left rectus.

Except for moderate temperature elevations on fourth and fifth days,

moderate abdominal distention, convalescence progressed satisfactorily. Patient out of bed on twenty-second post-operative day.

Several times, in the year following her operation, anastomosing the bowel was considered, but X-ray barium plates showed so wide a gap, that even the chance of mobilizing the sigmoid was considered inadvisable, as she was doing so well with her colostomy and did not, herself, care to assume too great risk.

She has remained well nearly fourteen years.

CASE VII.—*Carcinoma of Neck. Reported as Metastatic in Lymph Node.* A woman fifty-one years of age, was admitted to the hospital September, 1922, well nourished and of good color with a rather firm mass, the size of a hen's egg, in the left side of her neck anterior to sternomastoid, movable on deeper structures but attached to surroundings. Mass appeared three months previously as a small, firm, non-tender nodule well under the skin. No other masses or glands palpable. Past history negative for tuberculosis and negative except for abscessed teeth fifteen years before. Family history negative for tuberculosis or malignant disease. A careful physical, before operation, including nose, throat, pharynx, œsophagus, thyroid, vagina and rectum, revealed nothing abnormal nor has anything appeared in the seven and one-half years since operation. A provisional diagnosis of growth arising from brachiogenetic cleft was made; probably malignant from the feeling, complete absence of subjective or objective inflammatory signs or history.

A transverse incision revealed a tumor some six by three by three centimetres, quite definitely encapsulated, attached to carotid sheath. The upper extremity was less definitely encapsulated and there were attached a number of fibrous tissue clusters resembling very small grapes. No enlargement of cervical or superficial nodes could be demonstrated.

Microscopically, the larger portion of the mass was composed of solid carcinomatous growth, the nuclei of the cells of the tumor were large, vesicular, irregular and mitoses were extremely numerous. Sections also showed portion of a *lymph node at the periphery of the mass* and indicating that the latter was a *metastatic growth* invading the node. The source of the growth could not be stated. It seemed unwise and useless therefore, to do an extensive neck dissection. The noteworthy features seem to be: The rapid growth with intact capsule, lack of infiltration and apparent absence of other glands or masses; the apparent metastatic character of the growth and inability to demonstrate a primary source in seven and one-half years.

To what extent can the microscope be relied upon as a gauge of clinical malignancy?

The patient had one deep therapy X-ray treatment before leaving the hospital, where she remained but eight days following operation.

DR. FREDERIC W. BANCROFT asked Dr. Schley how his patients managed their colostomies. Frequently in his own experience he had found that patients gave up the cumbersome colostomy cups and invented methods of their own which were satisfactory.

In one case that Doctor Schley has reported he suggested reoperating and uniting the colostomy with the distal segment. Harvey Stone, of Baltimore, experimenting in dogs, had taken a loop of ileum, transposed it between the two ends of the bowel and made an end-to-end anastomosis of the proximal and distal portions of the ileum, from which the loop had been removed. In these cases he has had very satisfactory functional and radiographical results. Recently Stone has reported this procedure in a human case, with a resultant satisfactorily functioning lower bowel.

Dr. Carl Eggers commented on the fact that the entire subject of infection of the sigmoid is very little understood. As a matter of fact the condition is more common than is generally believed. A number of cases of that type have come under the care of Doctor Eggers, some forming very large tumors so that he was loath to believe they were merely inflammation of the sigmoid. One such case was referred to him with the diagnosis of twisted ovarian cyst, but eventually the correct diagnosis of sigmoiditis was made. The most interesting thing about the condition is the etiology. In this case, although running an elevation of temperature to 104° and with a high pulse rate, all cultures were constantly negative, the blood count was 30,000, and polynuclears 85 to 90 per cent. Some of these cases clear up without treatment and some perforate. One man diagnosed as carcinoma of the sigmoid was operated on by another surgeon last summer; he found a large sigmoid with inflamed walls. After dividing many bands of adhesions he let him alone. Recently the tenderness increased, temperature rose to 104°, the blood count became high, and as conservative treatment was started there was perforation into the adhesions from the former operation, after which it was easy to drain this abscess. He eventually succumbed. If this condition can be surgically handled, resection may at times be the procedure of choice. Doctor Eggers refered to a case now under his care operated on by Doctor Kammerer twenty years ago. Doctor Kammerer was under the impression he was dealing with a carcinoma and did a resection with a permanent colostomy. Doctor Eggers explained how this patient takes care of it. She moves about in society and has long lost any timidity. She has never used a bag. She applies a little zinc oxide in castor or olive oil, forming a paste, around the colostomy opening, places a small rosette of gauze in position around the colostomy and covers all with paper napkins held with a binder. After an accident, the entire dressing can be picked up and thrown away, and is easily replaced. There is at no time any odor about the patient. This simple dressing is being used in several other cases with excellent result. In case the bowels become loose as the result of ingestion of fruit, a powder containing a little powdered opium is given for a day or two.

Dr. Walter M. Brickner said that actinomycosis should be borne in mind as an occasional cause of massive sigmoiditis. Actinomycoses sometimes subside spontaneously in the bowel even while spreading elsewhere, which would explain recoveries in sigmoiditis with no other factor. Actinomycosis of the sigmoid is apt to be mistaken grossly for carcinoma or, sometimes, for diverticulitis. It should be remembered, too, that in actinomycosis there may be long periods when neither granules nor mycelia can be found in the pus.

Doctor Schley, in closing, replied to Doctor Bancroft that these patients seemed to have no trouble at all in handling the colostomy opening. The bag is merely a rubber ring and pouch held in place with a minimum amount

of pressure. As to the bowel movements, most of these patients have less constipation than before operation and daily enemas are not necessary. Several have to be careful with fruits and laxatives and a little mineral oil or milk of magnesia is usually sufficient when occasionally costive. In the case referred to by Doctor Bancroft, the reason Doctor Schley did not try to accomplish further union was because so much of the gut had been necessarily removed that there was a great probability of disturbed viability of the sigmoid in trying to bring it down. A permanent colostomy seemed not a heavy price to pay for much greater assurance of cure—and these bad cases have remained cured.

HARELIP AND CLEFT PALATE. AN ANALYSIS OF 184 CASES

Doctor Carl G. Burdick read a paper with the above title for which see page 35.

Doctor Burdick presented a number of cases illustrating his paper. The first group represented the incomplete clefts of the lip both single and double, most of which were converted into complete inasmuch as the tissue above the cleft was abnormal and had to be excised to obtain a satisfactory cosmetic result.

The second group comprised cases of complete cleft of the lip, alveolus and palate. In the majority of these the alveolus was moulded and wired at an early age to restore the normal curve of the alveolar arch and the lip repaired at the same sitting. Several operations were necessary to successfully close the palate in practically all these patients and a few complete failures were included. Three patients were presented in whom the lip was much flattened and contracted and this deformity was improved by taking a V-shaped piece from the lower lip and transplanting it into the upper lip.

In the fourth group several children and adults with complete and incomplete clefts of the palate which had been successfully repaired were presented to demonstrate the improvement in speech after attending a school for speech correction.

The last group included children which had recently been operated upon. A brother and sister with incomplete clefts required three operations before complete closure had been obtained and in two other children the repair was only partially successful after one or more operations.

Doctor Frank S. Mathews said: A few years ago there had crept into the medical mind a great deal of difference of opinion as to how to handle these cases. There was scarcely any agreement as to operative methods or time of operating. The methods recommended by Doctor Burdick, however, seem to be those upon which the operators of today have pretty well agreed. For the average case, the Langenbeck repair of the palate with rather moderate variations in detail has replaced other methods. Furthermore the tendency seems to be, in repairing the lip, first, to construct the nostril accurately and then close the lip after a simple denudation; this same method

replacing the numerous methods of cheiloplasty based on complicated denudation patterns. Emphasis should be first given to the restoration of the alveolar margin with the idea that restoration of function should be kept prominently in mind. If the jaw is not restored so that chewing is possible, growth of the jaws—chiefly the upper—is seriously interfered with. A chief defect, not usually mentioned, of the Brophy method is that the sudden narrowing of the entire cleft also immediately narrows the nasal cavities, establishing mouth breathing which may be permanent.

Surgeons are much handicapped in many of the cases by deficiency of tissue. Sometimes we are simply dealing with a cleft in tissues of fairly normal quantity, but there is every degree of deficiency. Brophy claimed the opposite, namely, that the amount of tissue is normal.

Doctor Mathews believes that in the future there is room for advance in handling these cases, in deciding whether tissue is adequate to make a functional palate with ability to close off the nasopharynx, or whether we had better admit defeat in advance of a failure and turn more of these cases over to the dentists for treatment by diaphragms. I doubt whether as much will be accomplished in any adult by operation in improving speech as can be gained from an appliance by an expert.

The great objection to the appliance treatment is the expense, whereas surgeons can always be found to operate gratis. The financial difficulty appears also when one considers expert speech training. His experience is that it is usually difficult to obtain. In most cases we have to rely on the parent alone. His advice to each mother is, first, no "baby talk," second, train the child to speak slowly, and third, exercise the palate muscles by the use of toys which require blowing and whistling.

As the speaker has shown, nothing has such a good effect on the alveolus and the entire length of the cleft in the palate as the restoration of the lip. Several times Doctor Mathews has closed the lip in the second twenty-four hours of life before the baby has lost weight and nutrition. Doctor Burdick has advised postponing the palate closure to a rather later period than has been his custom. One of the great difficulties which all encounter in recommending postponement of operation is the insistence of the parents on having the operation as early as possible. Personally, he has seen no objection to operating in the second year. It had seemed to him particularly difficult to get a good result on a double complete harelip and this he had attributed to a deficiency of tissue. If one uses all the lip available and makes the two lips meet below the prolabium one may get a long lip from above downward but so tight that it presses the teeth backward. This difficulty probably accounts for the recommendation which Brown and others have made of suturing each lip to the sides of the prolabium, thus producing a sufficiently broad lip at the expense of shortness with the necessary exposure of the incisor teeth. In a few cases of double cleft lip the speaker had thought it advisable to divide the operation into two, at the first replacing the premaxilla, restoring one nostril and suturing one lip to the prolabium; the second operation

restoring the other nostril and completing the lip operation. The Lane method had been tried by him a few times with some anatomical success but no success with regard to speech. Lane is to be credited with stimulating an interest in the entire subject but not with an advance in our operative methods.

The mortality of these cases is fortunately high, the hereditary element in its etiology being conspicuously prominent; and, if the inheritance is a Mendelian recessive, the damaged germ plasm will be inherited through an indefinite number of generations to appear when it is found in both parents.

Surgeons operate with the idea of improving the lot of these afflicted individuals. But it is certainly to the advantage of the race, that they should not reproduce their kind; and this is why he said that it is no misfortune that so many die in infancy with or without surgical treatment.

He had never used metallic plates to take the strain off the suture line. He doubted whether he made as long lateral incisions as some operators. Instead he had followed a suggestion of Dowd's and had packed the lateral incisions firmly with iodoform gauze to force the flaps inward. Sometimes the gauze comes out of itself and at other times he had removed it after several days.

It did him good to hear Doctor Burdick's table of operative results where among many favorable operative results he had to record so many multiple operations, for he also had had many unfavorable results. His results in palate work, so far as speech is concerned, had been distinctly unsatisfactory.

When one considers the variety in the extent of the deformity and the age of the patient one realizes that each case presents somewhat different problems. It is for this reason, among others, that he believed this work should be turned over to surgeons whose medical connections are such that they can get a good many cases. If the cases are to be distributed among all good surgeons no one will get enough to ever become expert at this work. Furthermore, some very good surgeons are temperamentally not suited to doing such good harelip and cleft palate work.

Doctor Henry Sage Dunning (by invitation) said that there are several things to keep in mind at the time of operation. If one operates and closes the lip in ten days the baby does not stand the operation as well as if it were done at the age of six weeks. If it is an anterior bony cleft this must be closed within three weeks if possible. When it is a cleft of the palate itself, it is the general opinion that it should be closed later, at about the third or fourth year. It is improbable that this interferes with the child's learning to talk; at any rate, this is not the important factor. There is a very strong feeling prevalent that the Brophy operation is not to be used except in rare cases. It is a difficult operation for most men to perform even though they are skillful in palate surgery and the results do not justify the operation. It is wiser to close the anterior cleft by premaxillary wiring after moulding the bones, but one must be very careful not to overdo even this. It would

appear that the general tendency is to get away from the procedure of wiring the bones as much as possible. The speaker did not place any value on the Lane operation whatever, except in the rarest of cases. The scissors flap operation, that is, bringing one flap over another and closing half the palate at a time, will do as much as the Lane operation can possibly do. Iodoform gauze packing on either side of the long lateral incisions is very important and takes the place of the complicated silver bands or other devices. As to the ribbons described by Doctor Burdick, Doctor Dunning did not think they were necessary. Regarding the mortality figures in the paper of the evening, this is difficult to explain but the answer probably lies in the fact that these should be pædiatric cases before and after operation, and should be carefully worked up, and none of the patients should be kept on the table for more than one hour for any reason whatever. If the lip breaks down it is probably due to infection or improper tension and this is a calamity that ought not to happen very often. There is generally a definite reason for it. Doctor Dunning believed that this work should be done by men who are especially trained to do it and that it is very difficult and unsatisfactory work at best.

Doctor Douglas B. Parker (by invitation) approved of Doctor Burdick's operation on the nares. Many of those cases usually seen had post-operative flattened alæ, but Doctor Burdick's cases have well-formed alæ, and good fullness, which is still better. The speaker called attention to one phase of the work in bilateral cases, viz., the saving of the premaxilla. It is often distressing to discover that the premaxillary bone has been lost in these flattened lips with no base of support for nose or nares, making it difficult to do proper plastic work. So many have had a V-shaped piece taken out and the premaxillary tilted back; the result is not functionally correct. A quadrilateral incision as advocated by Doctor Burdick is better. In regard to the lateral incision, most operators do not continue it back far enough; it is usually too small. In doing these cases to get greater function-ability of the palatal velar, it is often necessary to relieve the tension there. Doctor Burdick had not mentioned that except in reference to the operation of Dorrance. In regard to the mortality rate, this was surprisingly high. Too much emphasis cannot be placed on the fact that these children should receive especial care in preparing them for operation. These infants are primarily feeding cases and no operation should be done until the pædiatrist is satisfied that no infection is present and post-operative by the child should be placed in the hands of the pædiatrist again. Where this has been done the results have justified the procedures. In his mortality cases of cleft palate, Doctor Burdick reported that the temperature went up very high, 106° to 108° and a number died within twenty-four hours after operation. It is possible, as he said, that aspiration of blood may have played a part although it was doubtful if this were often true in so short a time. It might have been so in the later pneumonia cases. The selection of the proper time for the

operation means much, but the avoidance of traumatization of tissues means more. In the hands of the general surgeon the operation is not often warranted; the results are poor and the mortality rate is high. In the hands of the specialist these results can be improved.

Doctor Burdick, in closing the discussion, said that patients requiring training in speech correction had been referred to the National Hospital for Speech Disorders. He considered this an excellent institution and the authorities had been most willing to receive patients who could pay little or nothing. He congratulated Doctors Dunning and Parker on their splendid record of three hundred operations without a death and regretted that the mortality in his own series had been so high. Of course it was essential to exercise the utmost care in selecting the most favorable time to operate. Bellevue Hospital has an excellent pædiatric service which coöperates perfectly satisfactorily with the children's surgical service and he felt that the responsibility of the deaths was directly up to the surgeon and could not reflect in any way on the lack of attention on the part of the pædiatrician either before or after operation. While the sentiment of all the gentlemen discussing the paper seemed to be against the use of the metal bands, Doctor Burdick believed that his results were much better since employing them. He was glad of such a unanimity of opinion on the methods of Brophy and Lane and that all were in favor of Langenbeck's operation.

BRIEF COMMUNICATIONS

CHANGES IN THE HUMAN INTRAHEPATIC BILE DUCTS FOLLOWING CHRONIC CHOLECYSTITIS, CHOLELITHIASIS AND CHOLECYSTECTOMY

In a previous communication, Annals of Surgery, vol. xci, pp. 65-72, 1930, it was shown that certain changes occur in the intrahepatic bile duct epithelium of dogs following cholecystectomy. The normal intrahepatic ducts are lined with a smooth layer of simple cuboidal epithelium and as early as fifteen days after the removal of the gall-bladder there is a distinct

A B

Fig. 1.—A. Mucous fold of a dog's normal gall-bladder. B. Tip of an intrahepatic duct fold seventy-seven days following cholecystectomy (dog).

alteration of the morphology and the arrangement of these cells. The epithelial surface is irregular and large cells project into the lumen of the ducts. These changes were studied in sequence and it was found that mucous folds and villi develop in the intrahepatic ducts and that high columnar cells cover these projections. Seventy-seven days following cholecystectomy these folds and villi (Fig. 1B) are histologically identical to the mucous folds of the normal dog's gall-bladder (Fig. 1A). Ligation of the common bile duct

after cholecystectomy or with the gall-bladder intact results in enormous dilatation of the duct system; the epithelium becomes flattened and after death from such obstruction the bile ducts can be identified in sections only by their size; the epithelium has disintegrated and there are no projections into the duct lumina. From this evidence it appears that following cholecystectomy the intrahepatic bile duct epithelium becomes altered in order to assume functions normally performed by the gall-bladder.

In the human liver the smaller intrahepatic ducts are lined by simple low cuboidal epithelial cells which present a uniform smooth surface. As these

FIG. 2.—Normal human intrahepatic duct near the porta hepatis (human).

ducts are traced towards the porta hepatis it is seen that they increase in size and that the epithelium gradually becomes columnar. (Fig. 2.) At the junction of the intrahepatic and the extrahepatic ducts there is a sharp transition in the height of the cells and the ducts outside of the liver are lined with high columnar cells. In all locations in the intrahepatic ducts the epithelium normally maintains its simple arrangement and the surfaces of the ducts are smooth.

In chronic cholecystitis we have the development of excessive amounts of fibrous or scar tissue in the gall-bladder wall and alteration of its mucous membrane and submucosa. The normal functions of the gall-bladder cannot be performed under these conditions and we have *a functional cholecystectomy.*

With this premise in mind fifty routine liver sections obtained at autopsy were examined. In these subjects there was well-developed chronic cholecysti-

tis, cholelithiasis or the gall-bladder had been removed at a previous date for chronic cholecystitis or for cholelithiasis. The following examples are cited to show that following functional destruction of the human gall-bladder changes occur in the intrahepatic ducts which are similar to those found in the dogs following cholecystectomy.

A small intrahepatic duct in a section taken from a liver with a shrunken fibrotic gall-bladder (Fig. 3) shows two well-developed projections in the lumen which are covered with high columnar cells while the duct wall opposite to them is covered with low epithelial cells. The longitudinal section of a

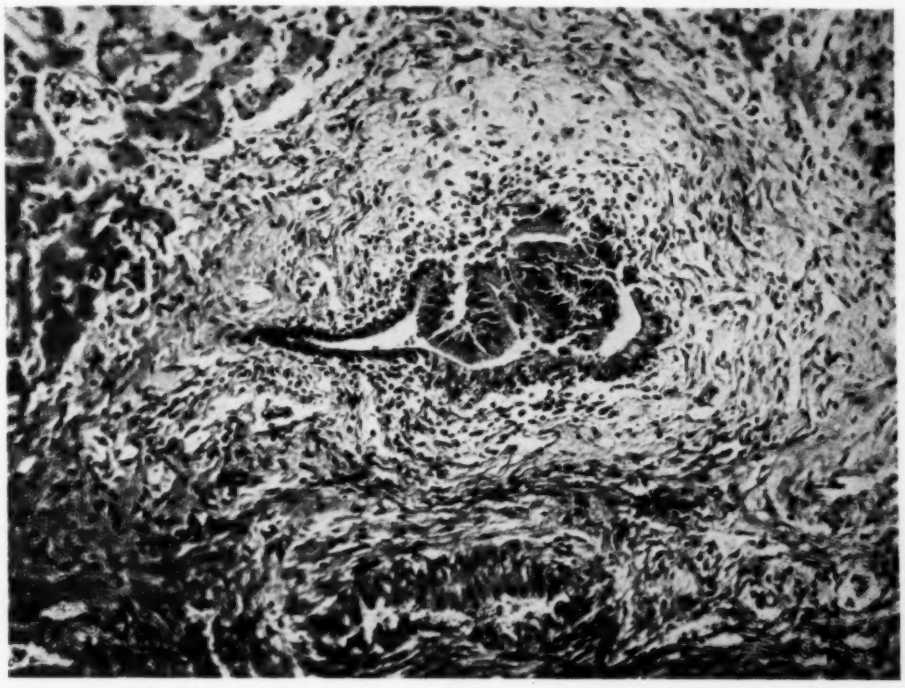

FIG. 3.—Small intrahepatic duct showing two projections covered with high columnar cells. Chronic cholecystitis with small fibrotic gall-bladder. No. 28-238 McManes Laboratory of Pathology, University of Pennsylvania.

small duct (Fig. 4) shows small projections in the luman. A cholecystectomy had been performed but the date of the operation was not given in the autopsy protocol. Common duct stones, dilatation of the common duct and stones in the gall-bladder are accompanied by the changes shown in Fig. 5. Specimen 00-44 showed common duct stones, a fibrotic gall-bladder the thickness of a thumb, portal cirrhosis, and a dilated common duct. A section of an intrahepatic duct near the porta hepatis (Fig. 6) shows well-developed folds. The existence of well-developed mucous folds and projections in an intrahepatic duct is shown in Fig. 7. In this subject the gall-bladder was dilated, its wall was thin and fibrotic and it contained 500 cubic centimeters of thick yellow bile and four irregular rough black stones. The ducts were all patent and pressure upon the gall-bladder forced bile into the duodenum.

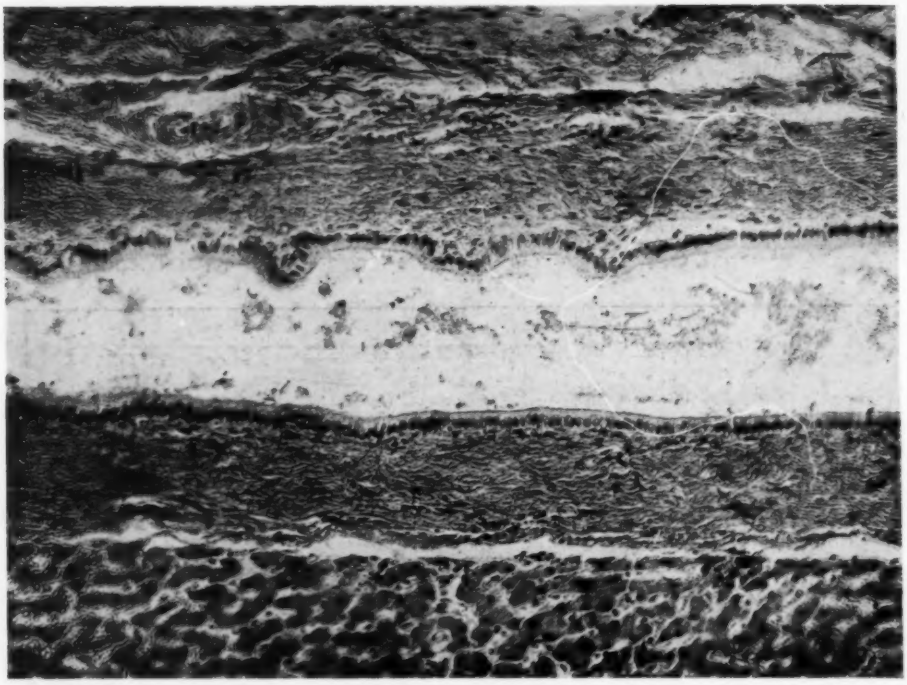

FIG. 4.—Longitudinal section of a small intrahepatic duct showing small projections. Cholecystectomy. Date not stated. No. 4158 13-49. McManes Laboratory of Pathology, University of Pennsylvania.

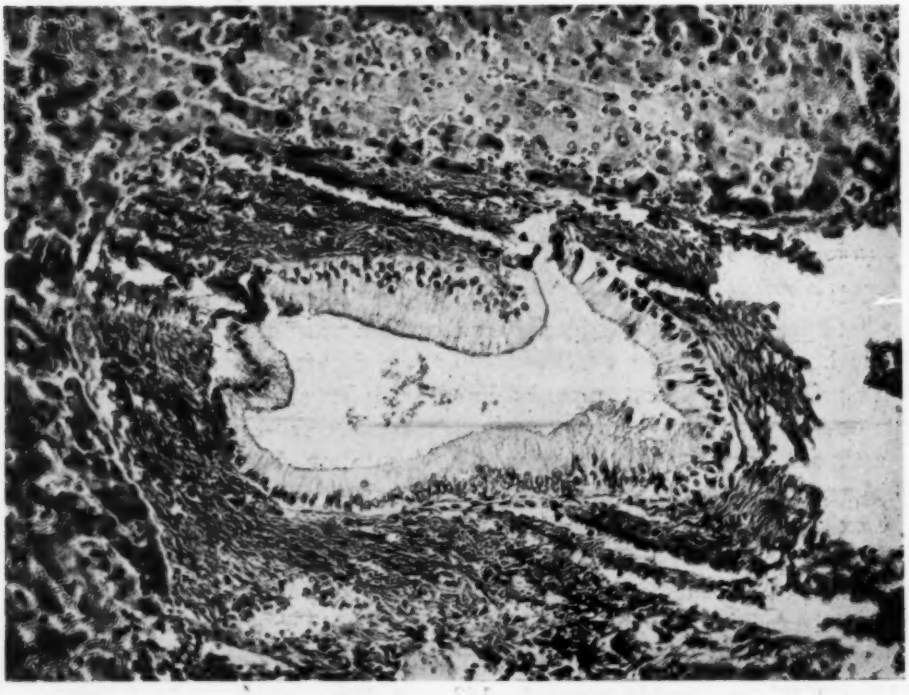

FIG. 5.—Duct near the porta hepatis showing well developed small projection. Chronic cholecystitis with stones; common duct stone with dilatation of the common duct. No. 4016 12-120 McManes Laboratory of Pathology, University of Pennsylvania.

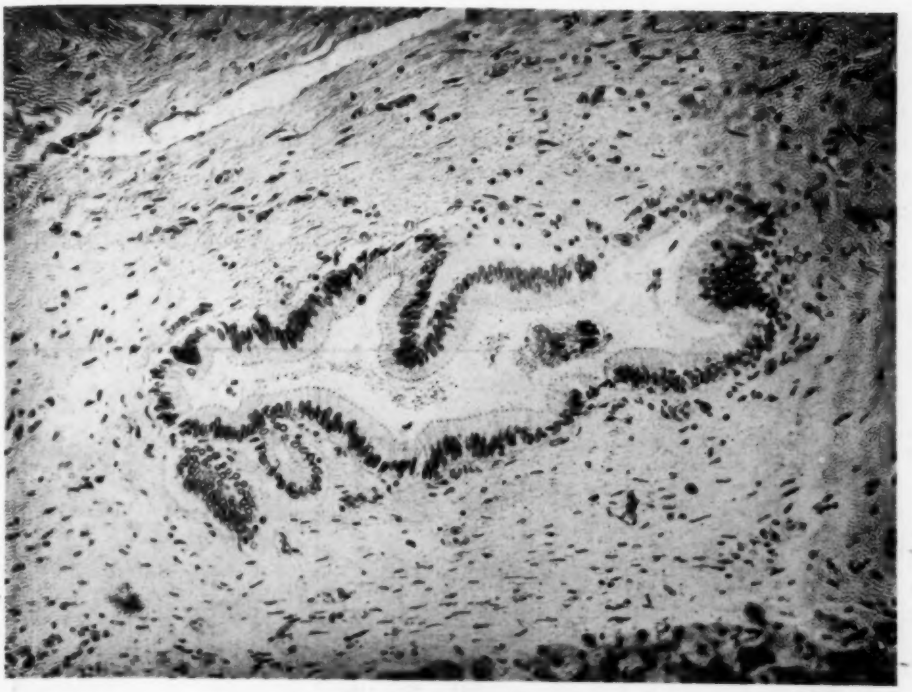

FIG. 6.—Duct near the porta hepatis showing definite mucous folds. Gall-bladder scarred and the thickness of a thumb; cholelithiasis; dilation of the common duct; portal cirrhosis. No. 00-44. McManes Laboratory of Pathology, University of Pennsylvania.

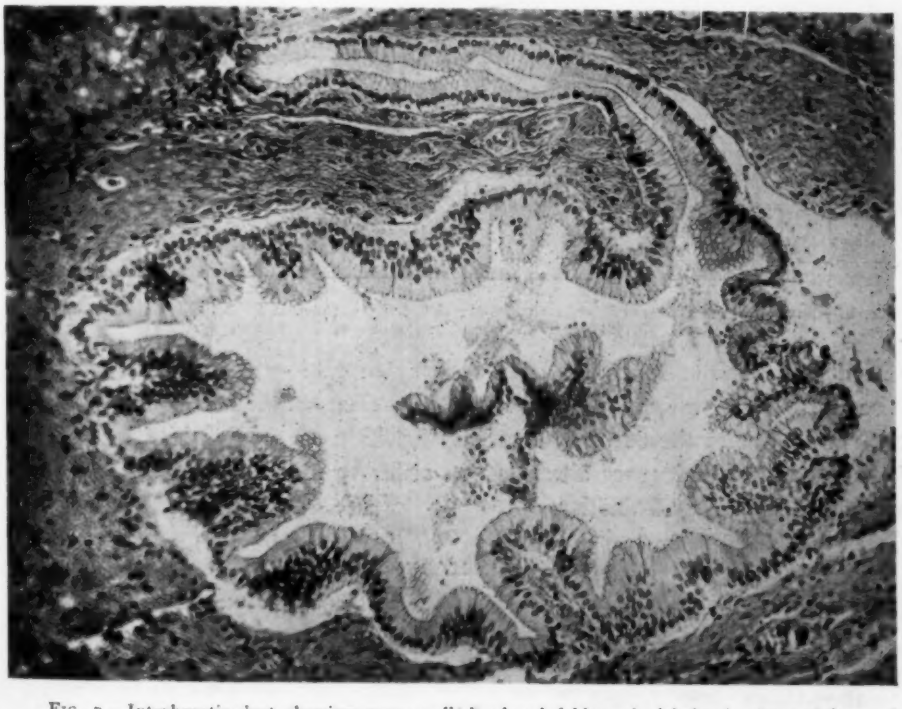

FIG. 7.—Intrahepatic duct showing many well developed folds and globules in the periphery of many cells similar to those often found in normal gall-bladder epithelium. Gall-bladder dilated, wall thin and fibrotic, contained 500 cubic centimetres thick yellow bile and four stones. No. 29-728. McManes Laboratory of Pathology, University of Pennsylvania.

An examination of these sections shows that the tunica propria of the mucosa does not enter the projecting folds and that each possesses its own fine stroma. This is convincing evidence that these projections in the lumina of the intrahepatic ducts are true mucous folds and not artefacts produced by contraction and infolding of the duct walls during fixation. Comparison of these folds with those found in a normal human gall-bladder (Fig. 8) shows a striking resemblance. Some of the cells in the duct folds (Fig. 7) show globules, especially at the tips of some of the projections, which are characteristic of the normal gall-bladder cells.

Portal cirrhosis and metastatic carcinoma of the liver, when not accom-

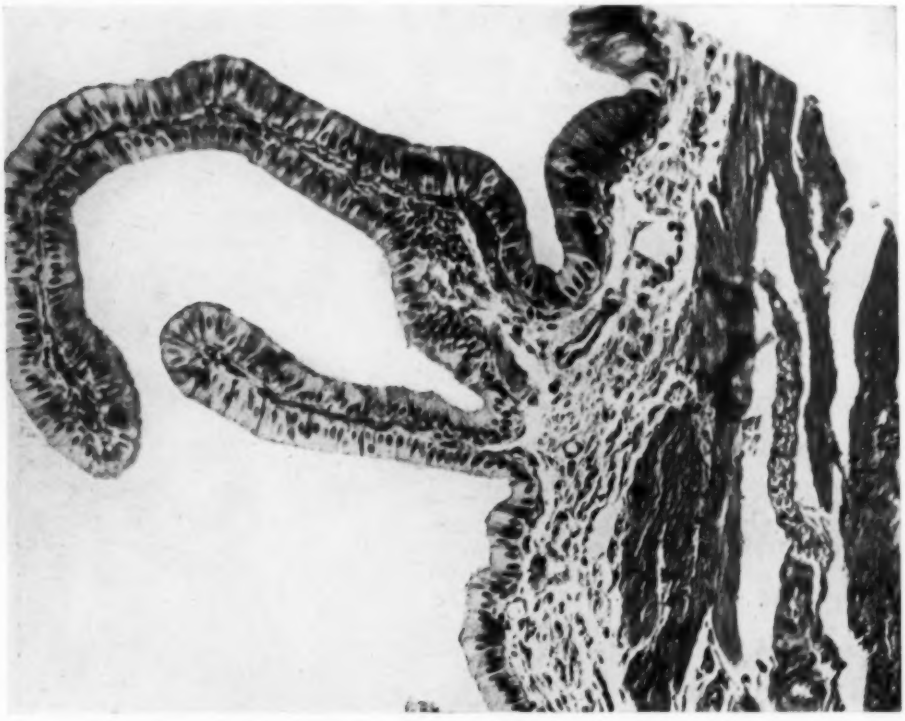

FIG. 8.—Normal mucous folds of a human gall-bladder. From "Chronic Cholecystitis without Stone." Frederic W. Bancroft. ANNALS OF SURGERY, November, 1923.

panied by chronic cholecystitis, cholelithiasis or cholecystectomy, do not produce these changes in the intrahepatic bile duct epithelium. The changes seem to be due to the destruction of the function of the gall-bladder and the duct epithelium undergoes alteration in order to assume functions normally performed by the gall-bladder.

SUMMARY

1. Definite changes occur in the dog's intrahepatic bile duct epithelium following cholecystectomy which may compensate for the loss of the gall-bladder.

2. In human beings chronic cholecystitis, with or without gall-stones, results in *a functional cholecystectomy.*

3. Cholecystectomy, whether functional or operative, is followed in the human intrahepatic bile ducts by the production of mucous folds and villi similar to those found in the normal gall-bladder.

4. The intrahepatic bile ducts in man and dogs appear to adapt themselves to perform functions of the gall-bladder following its destruction.

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IMMOBILIZATION BY STEEL SKEWERS IN FRACTURE WITH CONSIDERABLE LOSS OF BONE AND DESTRUCTION OF SOFT TISSUES.

C. C., an American, forty-eight years of age, was admitted to the Clearfield Hospital, February 8, 1928, at 1:30 P.M. About two and one-half hours previous to admission he had been hit by a bullet fired from a second-story window, a distance of thirty-five or forty feet, the bullet striking the patient's right arm just below the deltoid attachment, comminuting and shattering about five inches of bone, lacerating and dividing nearly all the soft tissues except the brachial artery, vein, and brachial plexus. The wound of entrance upon the anterior lateral surface of the arm was about the size of a silver dollar. The wound of exit upon the posterior medial aspect was the size of the whole hand; the pumpkin ball, which had been the type of bullet used, then tore into the muscle of the lateral surface of his flank and abdomen from the twelfth rib downward and was removed six inches below at the level of the iliac crest.

The wound of entrance and the large gaping ragged wound of exit were examined. Débridement of devitalized skin and muscle was done and entirely detached spicules of bone were removed. About two inches of the continuity of the bone at the musculospiral groove and two inches of the musculospiral nerve were missing.

The man had been engaged in shoveling manure at the time he received the wound. His clothes were badly soiled. Much of the soiled clothing had been carried into the wound as the explosion and tearing force of the large soft pumpkin ball was terrific when it shattered the bone. These two factors, the character of the wound and the great amount of contamination, stimulated us to do a thorough débridement and when finished, to be skeptical of the completeness of our efforts so that all thought of plating the bone or suturing of the wound was decided against. Hence, the following procedures were carried out: After the preliminary débridement, as above detailed, the intact part of muscles was tunneled, the torn ends of the musculospiral nerve were cut across above and below the area of evident gross traumatism with a sharp knife, twisting being avoided. They were then lightly sutured together, the ends being approximated. This approximation was possible because of the change in the course of the nerve, its bed being changed to the muscle tunnel anteriorly. This procedure was done not only to gain slack but also to take the nerve away from the area where callus would form. Part of the slack was obtained by the shortening of the arm due to the loss of bone. The maintenance of contour and the holding of fragments of bone in alignment were very well accomplished by the employment of "skewers." For this we used Wyeth hip-joint amputation pins. They were made to serve in the following

manner: A stab incision was made to the bone, high near the shoulder-joint, external and posterior. The pin was made to follow the bone until the point appeared in the wound and the point was guided across the gap of the wound and made to enter the distal side, grazing the bone all the way, until the point emerged just above the olecranon. A sterile cork was then used to cap the point. As one skewer did not give sufficient stability another was introduced in a similar manner antero-medially. The action of these skewers was very satisfactory. Introduction was quickly accomplished with no disturbance of bone as would have been the case with an attempted bone plating.

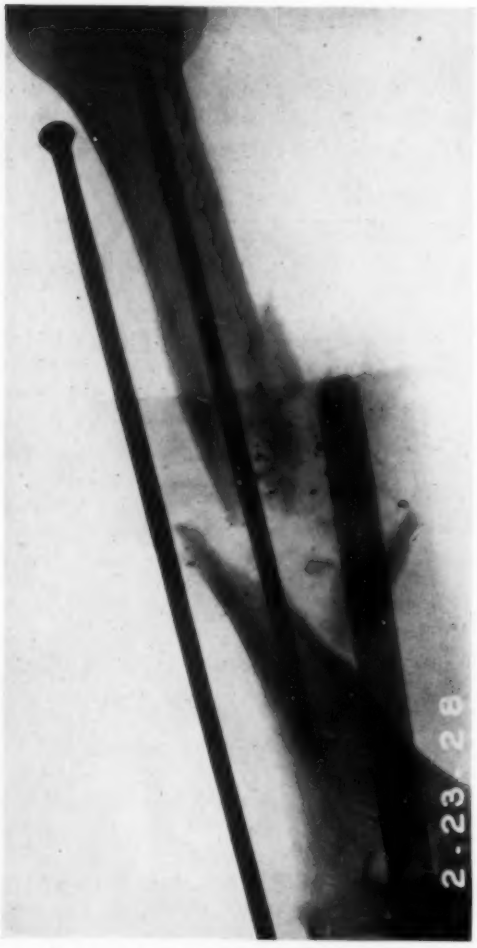

FIG. 1.—Use of steel skewers to immobilize gunshot fracture of humerus with much loss of tissue. Röntgenogram taken fifteen days after injury.

FIG. 2.—Case shown in Fig. 1 seventy-three days after injury. Note the particles of lead throughout the callus.

With some sheets of nickel alloy a molded splint was made that encompassed the arm through nearly half of its circumference, and was held in place with adhesive straps. The whole arm and forearm was then placed in an angular Thomas arm splint. The whole was suspended above the level of the body in order to prevent œdema. Great care was used that there were no constricting bandages nor adhesive strips. The wound in the arm was lightly packed with acriflavine gauze. The wound at the side of the body was freed from foreign matter and devitalized tissue; a counter opening was made over the bullet which could be palpated in front of the iliac crest near the anterior

superior spine. The bullet, which was found to have been flattened, was removed. Through and through acriflavine gauze drainage was placed. After the patient had recovered from the anæsthesia, 1500 units of antitetanic serum were given intramuscularly and later bacillus perfringens antitoxin.

The after-progress was unattended by any unfavorable incidents. By February 29 the wound had granulated and the skewer pins were removed. A molded nickel coaptation splint was applied, also an anterior and posterior plaster-of-Paris splint from the shoulder to below the wrist. A large window was left corresponding to the still open wound on the lateral surface of the arm. This area, in the course of treatment, was dressed with Beck's adhesive strapping and painted with mercurochrome. Hot air current was periodically applied. Dressings were continued until March 23, when the patient was allowed to go home. At the time of his discharge there seemed to be a rather abundant callus which was not as yet rigid.

The patient returned for inspection April 21. Check-up X-ray showed large callus and considerable lead through the tissues. May 19, check up showed the same result but callus much denser. Upon examination in March, 1929, a year and a month following the operation, I found an arm about one inch to one and one-half inches shorter, much scarred but in every other way a perfectly normal arm—good strong bony union, good muscular strength, no wrist drop, no loss of sensation or motor ability. The patient stated that he had been working hard and having no difficulty at all.

This case is reported because of the use of skewers instead of plates as the method of internal fixation, also placing on record the successful result of primary suturing of the radial nerve. A moderately extensive search of literature has failed to reveal a report of a case similarly treated by the use of skewers.

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KRUKENBERG TUMORS OF THE OVARY

SECONDARY tumors of the ovary are of considerable importance clinically, because they may be mistaken for a primary lesion. Of special interest is the group of secondary carcinomas known as Krukenberg tumors. They are usually easy to diagnose at operation because of their characteristic gross appearance, and in some instances their presence may even be suspected before operation.

CASE REPORT.—A married woman, thirty-six years of age, complained of uterine bleeding and abdominal pain, each of two weeks' duration. Six months before the onset of the present symptoms she had given birth to a normal full-term infant, the ninth child. Since that delivery she had lost twenty-five pounds in weight. She did not complain of any symptoms referable to the intestinal tract, and symptoms of gastric disturbance could not be elicited on direct questioning.

The thyroid gland was slightly enlarged, the heart and lungs were normal, the abdomen was full and rather tense. There was some tenderness in the region below the umbilicus. On percussion the abdomen was tympanitic in the mid-line, but dull in the flanks. The dulness was shifting. No tumor masses or abdominal viscera could be palpated. Vaginal examination revelead that the cervix was lacerated. The uterus was not enlarged. A bulging mass was found in the posterior cul-de-sac. The outlines of this mass were indefinite. Hæmoglobin 79.2 per cent. Sedimentation time rapid, 58 per cent. at the end of two hours.

When at operation the abdominal cavity was opened it was found to be filled with clear, straw-colored fluid, but the last portion to be removed was turbid. The blood vessels of the small intestines were injected. A tumor in the right ovary and a smaller, similar one in the left ovary were found. These were floating in the peritoneal cavity, fixed only by their pedicles. The fallopian tubes were œdematous and injected. A hard, indurated area could be palpated in the stomach. The ovarian tumors were removed.

FIG. 1.—Signet ring and spindle cells. Low power.

The patient made an uneventful operative recovery, but died four months later of cachexia. A post-mortem examination was not done.

Pathological description of tumors removed: Gross.—Two tumors, the larger measuring 10 by 6 by 4 centimetres and the smaller 6 by 4 by 2½ centimetres, retain the general shape and outline of an ovary. They are similar in color and consistency. The outer surfaces are smooth, slightly nodular, and pale gray in color. The cut surfaces are of a diffuse, mucinous, gray structure. At the periphery the tissue is firm and homogeneous, but in the centre it is softened and broken down, with the formation of a few small cysts.

Microscopic examination.—The tumor tissue possesses two main characteristics, and these are revealed in all sections from both tumors. It is composed largely of densely cellular areas alternating with some sparsely cellular ones, the latter having a large amount of mucoid ground substance. (Fig. 1.) The densely cellular areas are composed of large oval and round-cells filled with mucus. The nuclei are compressed to the periphery into a crescent shape giving the cells a signet-ring appearance. (Fig. 2.) The cells are massed together with very little stroma between them. The sparsely cellular areas are composed of spindle-shaped cells. These are loosely scattered about and separated by the mucoid substance, and are generally more numerous around the blood vessels. (Fig. 3.) These spindle-cells give this portion of the tumor a sarcomatous appearance. Occasional multinucleated cells are found. In some areas columnar cells without mucus are found, and these seem to have been polarized along a scanty stroma into tubule-like formations.

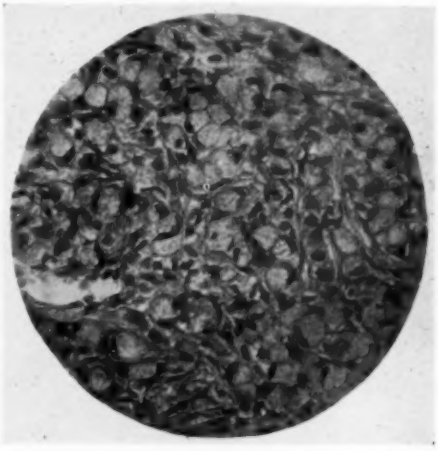

FIG. 2.—Signet ring cells. High power.

Diagnosis.—Bilateral Krukenberg tumors of the ovaries.

Discussion.—The diagnosis of Krukenberg tumors of the ovary is usually quite easy. They are nearly always bilateral and unequal in size. They characteristically maintain the shape of an ovary. Their opaque gray and lustreless color, and on section the mucoid degeneration, are usually suffi-

cient evidence to make the diagnosis. In addition, they are nearly always free of adhesions and seem to float freely in the peritoneal cavity from their pedicle. However, the tumors may be firmly bound to the uterus. Microscopically, the signet-ring cell formations, the fibroblastic or spindle-cell stroma, and the mucoid ground substance are pathognomonic.

Krukenberg [1] (quoted by Jarcho) first described these tumors in 1896 and considered them of connective tissue origin and primary in the ovaries. He called them fibrosarcoma ovarii mucocellulare, and recognized their tendency to metastasize through the lymphatics. Numerous authors since Krukenberg have reported similar tumors and established that they are carcinomas and secondary to gastro-intestinal carcinoma. In the majority of the cases on record the primary tumor was in the stomach. Major,[2] in 1918, reviewed the subject and collected fifty-five authentic cases. Fallas,[3] in 1929, added twenty-three. Jarcho [1] states that Schlagenhaufer had collected seventy-nine in 1902, but that he recorded sixteen of these as primary in the ovaries. In addition to the cases collected by Major and Fallas we have been able to find six additional cases in the literature.[4, 5, 6, 7, 8, 9] Of these, the case reported by Bourg and Cordier [5] was unilateral. Although there are cases on record in which the primary tumor had not been discovered, the evidence is overwhelmingly in favor of these tumors being secondary, and in the majority of cases they have been secondary to carcinoma of the stomach. Some authors (Marchand, quoted by Jarcho [1]) claim that these tumors may be primary. However, unless the most accurate and complete post-mortem studies have been made, such cases cannot be accepted as proved. The primary tumor in the stomach may be so small as to require serial sections (Major).[2]

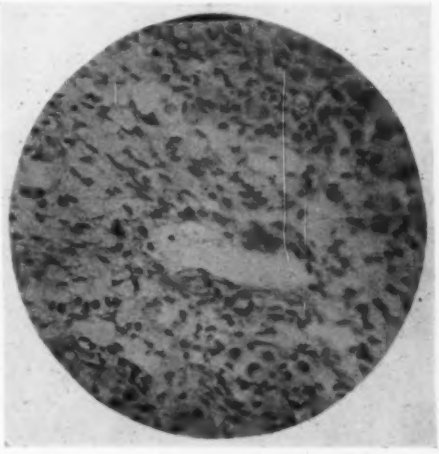

FIG. 3.—Spindle cells and mucoid ground substance.

The theories presented to account for this rather unusual form of metastases are three: The first is the implantation theory, which implies that the cells have floated down through the peritoneal cavity from the primary tumor and have implanted themselves in the ovary. This theory is difficult to understand, because it would seem rather unusual that the cells in their course through the peritoneal cavity would not implant themselves on other organs. In addition, one would expect to find on histological examination evidence of implantation on the outer surface of the ovaries. Numerous sections taken through our specimens failed to reveal tumor cells on the outer surface. Jarcho [1] records a similar experience. The second theory is that the tumor cells reach the ovary by the blood-stream. The symmetrical

distribution of the tumor cells in the ovaries might be explained on this basis. The third theory is that the tumors arise as a result of retrograde lymphatic involvement, and this would imply that the lymphatic cistern under the diaphragm has been blocked by earlier tumor involvement. The early development of ascites is somewhat in favor of this. The fact that later lymphatic extension occurs is additional evidence.

Conclusion.—An instance is reported here of Krukenberg tumors of the ovaries. Six additional reports have been found in recent literature, bringing the total number on record to eighty-five. Until a primary tumor elsewhere has been ruled out, this condition must be considered as metastatic. The gross appearance and microscopic structure of these tumors are characteristic.

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RECONSTRUCTION OF ANAL SPHINCTER BY MUSCLE SLIPS FROM THE GLUTEI

IN THE ANNALS OF SURGERY for August, 1929, Dr. J. Louis Ransohoff, of Cincinnati, Ohio, reports a case of successful reconstruction of the anal sphincter by the use of Wreden's method of reconstructing voluntary anal control. He also refers to two cases reported by H. B. Stone, of Baltimore, one of which was successful. Wreden's method is by the use of strips of fascia and is used in cases where the sphincter is still present. I wish to report a case with loss of the entire sphincter muscle in which anal control was obtained by the use of muscle slips from the glutei. In looking up the literature on this subject I found that this procedure was first reported by Schoemacher [1] in 1909. His procedure is practically the same as that which I used. In both our cases the sphincter was gone.

CASE.—W. C., male, forty-six years, was first seen July 17, 1929, complaining of protrusion of the rectum of six months' duration and recently bleeding. He had been operated upon five years previously for carcinoma of the rectum at which time an excision of the tumor was done by the Kraske technic, removing the coccyx, lower bowel

[1] Plastische Ersatz des Sphincter Ani. Verhandl. d. deutsch, ges. f. Chir., vol. x, pp. 177–179, Berlin, 1909.

and sphincter. The end of the healthy bowel was drawn through the operative opening near the sacrum. The patients recovery was uneventful and up to the present complaint, bowel control had been maintained by stool consistency as in colostomy. About one year ago owing to family and financial worries, the patient became careless of his physical condition. He also began drinking heavily. About six months ago, he noticed a protrusion of the bowel when straining. This gradually became more marked and for the last two weeks there had been bleeding which was quite pronounced. He could reduce this protruding mass but it would immediately prolapse upon assuming an upright position.

He was a fairly well-developed and nourished white man apparently in no pain. Head, eyes, ears, throat, teeth negative; heart and lungs negative, abdomen negative. The perineum showed a cauliflower-like red, angry-looking mass about the size of a grapefruit with several ulcerated bleeding areas covered with a dirty slough. On reduction of this mass the perineum showed a jagged scar in the centre of which was an opening about two inches in diameter, the circumference consisting of a thin ring of scar tissue. No muscle was present. The protruding bowel measured about four inches in diameter. No signs of malignancy were noted. In view of the fact that the sphincter and the levatores ani had been removed at the previous operation, it was thought that the removal of a circular cuff from the prolapsed bowel plus the manufacturing of an artificial sphincter from gluteal slips might prove successful.

Operation.—Under gas-oxygen-ether, a circular incision was made about one inch away from the rectal opening, leaving one inch uncut anteriorly. The bowel was freed from the surrounding tissues beyond the upper limit of the protruding mass. It was found to be especially adherent to the sacrum posteriorly, requiring considerable effort to dissect loose. A circular cuff about one and one-half inches in width was taken from the bowel down to the muscular layer. The mucous membrane was then joined with an intestinal stitch, and the mass replaced in the pelvis. As the coccyx had been removed previously, the operative area was bounded posteriorly by the sacrum and postero-laterally by the glutei. A strip of muscle about one-half inch wide and long enough to reach below the anterior of the bowel orifice was cut from each gluteus, leaving its origin intact. These strips were then fastened together anterior to the bowel, drawing them through a tunnel which had been made through the scar tissue which was left at this point. This secured the bowel opening in a hammock of muscle. Owing to the wide separation of the muscles at the sacrum, it was found impossible to fasten them together posteriorly merely by sutures. Therefore the medial portions of the muscle bands were incised and swung behind the anal openings and fastened. Laterally, these were also fastened to the main muscles. Number 1 40-day chromic catgut was used for the muscle suture. The rectum was thus completely surrounded by a band of muscle. The skin was then closed with interrupted non-absorbable sutures, drains being placed in each ischio-rectal fossa. The patient's convalescence was stormy owing to the fact that on the seventh day he obtained some whiskey, became intoxicated, sitting down and tearing out the stitches. The wound became infected requiring daknization but the muscle platform held, and gradually the incision healed. Two months later, the wound was entirely closed. At that time the bowel opening permitted the introduction of two fingers and the patient, by contracting the glutei, pulled the bowel posteriorly, compressing the fingers quite forcibly. Two months later the patient stated that he had nearly perfect bowel control. He had not soiled himself for the last month. He however still dieted very carefully and he was told that, undoubtedly, he would have to continue to do so to a certain extent for the rest of his life. He has not been seen since then, a period of nearly five months. When last heard from about a month ago, he wrote that he was feeling fine, had gained weight and that his bowel control was perfect.

This technic which was elaborated without the knowledge of Schoemacher's previous work differs from his only in the exact procedure, the

idea and the anatomical structures used being the same. This technic, unlike Wreden's, is applicable to cases in which there is no sphincter and judging by our case the chances of success are good.

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RUPTURE OF A PRIMARY BRONCHUS FROM COMPRESSION OF THE THORAX WITHOUT BONE INJURY

THE rupture of a bronchus as a result of compression of the thorax is unusual. Where there is no injury to the overlying bony thorax, it is a rarity, and such cases seem worthy of report. In 1912, Schönberg [1] reported three cases of his own. In two there was no bone injury, and in one there was a fractured rib, but no injury to the pleura. He also collected from the literature thirteen cases of bronchial rupture in which thoracic compression was the dominant feature. In only four of these, however, was there definite evidence that no overlying ribs had been fractured. Since then, King,[2] Mumford,[3] and Thomas [4] have each reported single cases in which bronchial rupture followed compression of the thorax and in which there was no fracture of the overlying bony frame work. To these cases we can now add the following report:

A robust young negro, of nineteen, fell from the front fender of a truck and was crushed between this vehicle and the road bank. Pressure was relieved only after his body had made nearly a complete turn, the maximum force being exerted on the antero-lateral portion of his right chest. Following this he became cyanotic, had great difficulty in breathing, and presented the picture of shock. Breathing was possible at this time only when the patient was recumbent. He was taken at once to the University Hospital.

On admission there was cyanosis of the face and neck, subcutaneous emphysema of the right upper chest and supraclavicular region, and marked dyspnœa. There was no evidence of injury to the chest wall. The only other abnormal sign recorded was a diminution in the breath sounds over the right chest. Temperature 101.2°, pulse 108, respiration 22. An X-ray of the chest was taken and the following report made: "A flat film of the chest shows a partial collapse of the left lung with displacement of the left diaphragm. The right lung shows a somewhat homogeneous increase in density, probably caused by pressure plus congestion. Over the right chest there is extensive subcutaneous emphysema which runs well down into the axilla and as high as the soft tissues of the neck. No evidence of bone injury can be demonstrated in the thorax. Conclusions: Left pneumothorax with cardiac and mediastinal displacement to the opposite side. Extensive subcutaneous emphysema over the right chest. Atelectasis of the left lung with beginning congestion of right lung." (See Fig. 1.)

When first seen by one of us, several hours later, the only new findings noted were an increase in the respiratory rate to 50 and acceleration of the pulse rate to 130. There was evidence of a partial left pneumothorax. It was thought that the patient was suffering from mediastinal emphysema and a pneumothorax due to a rupture of the lung. Two hours later, there having been no change in signs, it was decided to aspirate the left pleural cavity to ascertain the presence of a valvular pneumothorax, planning to establish drainage should such be found. Accordingly, with the patient in a sitting position, a needle was inserted through the seventh interspace in the left mid-axillary

line. The rubber tube attached to the needle had its free end placed under normal saline solution and air bubbled out at a rapid rate. After a few minutes air ceased to flow and there was evidence that a slight negative pressure existed. The needle was kept in place for about twenty minutes in order that we might be certain that there was no continuous leakage of air into the pleural cavity. During this procedure the patient's condition twice became critical but on each occasion there was response to stimulation with caffein and adrenalin.

Following the aspiration the patient continued to go steadily down hill and died sixteen hours after the accident. There was no increase in the extent, or tension, of the subcutaneous emphysema and it was felt that no operative interference was indicated.

Abstract of necropsy findings.—"Over the right cheek bone there was a large superficial abrasion of the skin. Over the upper right thoracic region there was sub-

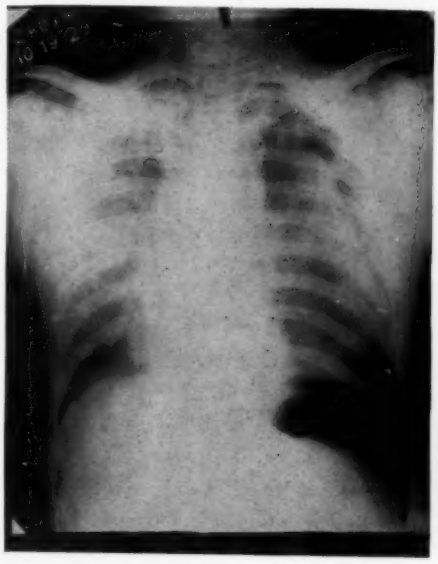

FIG. 1.—Röntgenogram of chest showing partial pneumothorax on left and subcutaneous emphysema on right.

FIG. 2.—Photograph showing transverse rupture of right main bronchus.

cutaneous emphysema, giving a crackling sensation on palpation. The subcutaneous tissues, particularly under the pectoralis major muscle, were markedly emphysematous and showed definite areas of hæmorrhage. The pleural cavities on either side showed no signs of inflammation or of fluid. The mediastinal structures and heart were in normal position. There were no puncture wounds of the parietal pleura and no fractures of the ribs or sternum could be seen. The tissues of the mediastinum were emphysematous and contained irregular splotches of hæmorrhage into the tissues. There was no purulent exudate.

"A complete transverse rupture of the right main stem bronchus was found five centimetres below the bifurcation of the trachea. (Fig. 2.) The rings of the bronchus with their mucosa were completely separated. The peribronchial tissues were not involved, except on the anterior aspect. The tissues were somewhat congested but no purulent material was present. The bronchial lining was also markedly congested and inflamed, but no exudate was present. No gross pathology of the cartilaginous rings was noted.

"The lungs were both of normal size and showed only an extreme congestion toward the bases. A close inspection of the left lung did not reveal the cause of the pneumo-

thorax found ante-mortem. Each lung contained an old healed tuberculous process in its apex. The heart, kidney, spleen, and liver were all apparently normal except for a bluish-purple discoloration, apparently an internal cyanosis of all the organs."

There seem to be two possible explanations for the presence of air in the left pleural cavity before death. The first is, that there had been a very small rupture of the lung which allowed the escape of air into the pleural cavity but which became sealed when the pressure of the air became sufficiently great. This would be compatible with the findings at the time of the aspiration of the chest but not with the evidence of an intact lung as found at autopsy. However, it must be possible for a small rupture to appear completely sealed after sixteen hours. The other possibility is the escape of air through a temporary opening in the mediastinal pleura. This is certainly less tenable as the ruptured bronchus from which the air would come was on the right and there was no leakage of air from it into the right pleural cavity. The origin of the interstitial emphysema is more obvious. The air escaped from the mediastinum along the deep fascial planes into the neck and thence over the upper chest and into the right axilla. This course has been observed both clinically and experimentally.[5]

The mechanism of bronchial rupture, as suggested by Schönberg, would seem to cover adequately the findings in the case here reported. He believed that there are two important factors. The first is, the compression of the bronchus between the elastic chest wall and the rigid spine; and the other, the marked increase in pressure in the air passages due to the fact that at the time of impact the lungs are in an inspiratory phase and the glottis closed. The bronchi, being less resilient than the lungs and pursuing a horizontal course, suffer the more.

Diagnosis of the condition is rarely, if ever, made. The signs according to the location of the rupture and the involvement of the pleura will vary. As the force necessary to produce this injury must be great, there will also be damage to other mediastinal structures and to the lungs, which in turn will give rise to respiratory and circulatory symptoms. There will then be in all cases evidences of respiratory difficulty with probably a pneumothorax or subcutaneous emphysema, or both. If the period of acute symptoms is survived, the diagnosis and exact location of the rupture can be established by bronchoscopic examination.

There has been found the report of only one patient who survived a ruptured bronchus. This case was reported in 1928 by Krinitzki.[6] The diagnosis was not made, however, until an autopsy was performed twenty-one years later. The patient as a girl of ten had a full wine cask fall from a wagon on her chest. She had four ribs on her right side broken and she recovered slowly. Later, she had recurring attacks of right-sided pleurisy. Seven years after this she developed evidence of tuberculosis of the left lung, from which she died after fourteen years. At the autopsy, the left lung, although found to be extensively involved with tuberculosis, more than filled the hemithorax. The right lung was contracted and airless and was adherent to the pericardium. The right bronchus extended downward three centimetres from the bifurcation and ended in a blind stump surrounded by connective tissue. Three centimetres

farther along in the hilus was found the continuation of this bronchus with its proximal end embedded in scar tissue. A careful study of the over-lying ribs failed to reveal any evidence of an old fracture.

In considering the treatment of patients with bronchial rupture, certain fundamental points must be kept in mind. Primarily, any force sufficiently great to injure a bronchus must also greatly traumatize the mediastinal structures and throw the victim into a state of shock. This fact is of the greatest importance, for rupture of a bronchus *per se* may give no symptoms. Associated with the break in continuity of the air passage, there will be a tear of the pleura, rupture of the lung, or the establishment of an opening into the mediastinum. Œdema of the mediastinal tissues is almost inevitable and hæmorrhage not infrequent. The most important factor from the standpoint of treatment is the continuous escape of air from the ruptured bronchus. When this occurs its control is urgent and must be attended to even while the patient's shock is being combatted. With the continuous escape of air into the pleural cavity a tension pneumothorax will develop which will require valvular drainage. Air escaping into the mediastinal tissues will soon also reach the soft tissues of the neck. Incision in the episternal notch may be sufficient to give relief to this entrapped air, though it will at times be necessary to add suction, as suggested by Tiegel,[7] or, even, to perform mediastinotomy. In some cases, as in our own, there is no continuous leakage of air and accordingly no operative interference is indicated. Most of these patients, however, succumb to the trauma to the adjacent structures. If the patient survives the early critical period and evidence of an open bronchus persists, one might consider an attempt at operative repair of the bronchus. Closure of bronchial defects has been successfully done in experimental animals and the procedure has been suggested for human cases. However, treatment of the bronchial wound must be considered of secondary importance to the treatment of the acute phenomena.

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CONGENITAL CYST OF THE COMMON BILE-DUCT

AN INFANT, six weeks old, was admitted to the Jackson Memorial Hospital August 17, 1929. The child had apparently had a normal birth, but soon became jaundiced, the icterus steadily increasing. Two weeks after admission to the hospital, the child was circumcised, which operation caused an extreme bleeding, but this was finally stopped. At about the same time, a progressive enlargement of the abdomen was noticed and the child refused nourishment. It had become profoundly anæmic. Examination revealed a tumor in the abdomen. Ten cubic centimetres of the mother's blood were given intramuscularly. The child died on the night of admission.

FIG. 1.—Congenital cyst of the common bile-duct. 1.—Pylorus. 2.—Papilla Vateri. 3.—Cyst. 4.—Gall-bladder. 5.—Lig. teres hepat.

At autopsy there was found a cyst about four and one-half inches in diameter, present below the liver, carrying on its anterior surface the extended duodenum. (Fig. 1.) Pushing the duodenum forward, this sac was found to be in communication with the common bile-duct on two sides. The cystic duct appeared normal, but the gall-bladder was collapsed. The pancreatic ducts opened into the same cyst. The tumor contained bile. There was some bile present in the duodenum. The direction of the common duct at reaching the papilla of Vater was from left to right and not as in the normal, from right to left.

The origin of this rare condition, a so-called idiopathic choledochus cyst, is explained by some authors with the supposition of an abnormal weakness of the wall of the common duct. Others believe it due to the presence of ectopic pancreatic elements. In nearly all cases (about twenty have come to observation) the above-mentioned abnormality of the course of the intraduodenal part of the common bile-duct was present. Most authors believe that this fact leads to the occlusion of the duct by a valve mechanism as soon as the duodenum widens, which, in normal cases, would tend to open

the papilla. Due to the extreme rarity of this condition, the diagnosis has been made in only a few of the known cases. Two cases, however, have been operated on with success. The prognosis is rather unfavorable, since, in addition to the usual danger of cholemia, an infection of the stagnated contents of the cyst usually takes place.

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PAROVARIAN DERMOID CYST

AUGUST 11, 1929, a woman, thirty-seven years of age, was admitted to the hospital, suffering from pain and tenderness in the right lower abdominal quadrant, nausea and vomiting, all lasting during the previous twenty-four hours.

The patient's health had always been good. There was some slight discomfort in the right lower quadrant for the past ten years, but never embarrassing. There was no history of intestinal upset or pelvic inflammation, patient was six months pregnant.

FIG. 1.—Parovarian dermoid cyst ovary.

Immediate operation was done as follows: Right rectus incision about three inches long. After packing away the intestines, a large bluish mass about as large as a medium-sized grapefruit came into view. The mass was clamped off at the pedicle and removed. The appendix was normal, also the left ovary.

The surgically removed specimen consists of three parts (Fig. 1): (1) The cyst itself, irregularly shaped, of about six inches diameter, discolored by congestion. (2) The Fallopian tube, somewhat thickened and blood-tinged. (3) The ovary, apparently normal, containing a corpus luteum. The cyst apparently developed within the broad ligament, distinctly apart from the ovary, and therefore must be considered as a parovarian cyst. On opening it, the characteristic conditions of a dermoid cyst were found (sebaceous débris and hairs; there were no teeth present).

There seems to be little to be found in literature about parovarian dermoid cysts. The few papers which were available for me, dealing with this subject, are the following: *Mattoli* described one case in 1895. He thought the condition to be of considerable rarity. *Tourneux* and *Fabri* in 1914 described a

case and thought the condition to be extremely rare. In the same year, however, *Vautrin*, in a paper dealing with dermoid cysts, expressed the opinion that most of the dermoid cysts believed to originate in the ovary are, in fact, of parovarian origin. Based on a series of observations, he stated that it is frequently of parovarian origin at the periphery of the ovarian hilum. On the posterior side of the wing of the Fallopian tube, the dermoid cysts are encountered. The location preferred by the dermoid is the periphery of the ovary, and it sometimes encroaches in such a way that it could be considered as included in the ovary. However, Vautrin states it remains distinct from the glandular parenchyma, from which it is easily separated without involving the ovigenous bed. Four times, the author has verified this fact, but that the relationship of simple proximity may easily be made evident, the cyst must still be of small size. From the time when it takes on an important development, its relation with the gland becomes more intimate, so that it finally cannot be distinguished from an intraovarian tumor.

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